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STANFORD ICHTHYOLOGICAL BULLETIN

VOLUME 7 NUMBER 4

THE MARGARET HAMILTON STOREY MEMORIAL ISSUE

Published by the
NATURAL HISTORY MUSEUM OF STANFORD UNIVERSITY
STANFORD, CALIFORNIA, U.S.A.

1960

STANFORD ICHTHYOLOGICAL BULLETIN
CONTENTS OF VOL. 7, NO. 4

Title and Author	Page
A contribution to the Ichthyology of Nepal. By Hugh H. DeWitt	63
A New Zeomorph Fish of the Family Oreosomatidae from the Coast of California, with Notes on the Family. By George S. Myers	89
Two New Fishes Collected by General Thomas D. White in Eastern Colombia. By George S. Myers and Stanley H. Weitzman	98
Pyrrhulina spilota, a New Species of Characid Fish from South America. By Stanley H. Weitzman	109
The Systematic Position of Piton's Presumed Characid Fishes from the Eocene of Central France. By Stanley H. Weitzman	114
The Mormyrid Genera *Hippopotamyrus* and *Cyphomyrus*. By George S. Myers	123
Note on the Flatfishes of the Genus *Poecilopsetta* Occurring in Altantic Waters. By James C. Tyler	126
The Genera and Ecological Geography of the South American Banjo Catfishes, Family Aspredinidae. By George S. Myers	132
Figures and Descriptions of Four South American Catfishes of the Genus *Corydoras*, Including Two New Species. By Stanley H. Weitzman	140
Figures and Description of a South American Catfish, *Corydoras reticulatus* Fraser-Brunner. By Stanley H. Weitzman	155
Fishes of the Stanford Antarctic Biological Research Program, 1958–1959. By Hugh H. DeWitt and James C. Tyler	162
Erythrocyte Counts and Hemoglobin Determinations for Two Antarctic Nototheniid Fishes. By James C. Tyler	199
A Brazilian Pike-Characid, *Boulengerella lateristriga*, Rediscovered in the Rio Negro. By George S. Myers and Stanley H. Weitzman	201
The South American Characid Genera *Exodon*, *Gnathoplax*, and *Roeboexodon*, with Notes on the Ecology and Taxonomy of Characid Fishes. By George S. Myers	206
Preface to any Future Classification of the Cyprinid Fishes of the Genus *Barbus*. By George S. Myers	212
Further Notes on Characid Fossils. By Stanley H. Weitzman	215
Further Notes on the Relationships and Classification of the South American Characid Fishes of the Subfamily Gasteropelecinae. By Stanley H. Weitzman	217
The Phylogenetic Relationships of *Triportheus*, a Genus of South American Characid Fishes. By Stanley H. Weitzman	239
A Forgotten Account of a Fresh-Water Belonid Fish from Northern India. By George S. Myers	245
The Names of the South American Catfish Genera *Conorhynchos* and *Diplomystes*. By George S. Myers	246
The Authors in this Issue	248

NOTICE.—The Bulletin is issued irregularly. It is offered in exchange to institutions for their serial publications, and is widely distributed on or before the date of issue to the principal zoological libraries of the world. The Editors are Prof. George S. Myers and Miss Margaret Storey. Address all communications to the Director of the Museum. This issue is published on October 28, 1960.

MARGARET HAMILTON STOREY (1900-1960)

This was the last number of the Stanford Ichthyological Bulletin to be edited by Margaret Storey. She worked on its editing through the spring and summer of 1960, despite increasing illness. As the number went to the press, at the end of September, she entered Children's Hospital in San Francisco for a serious surgical operation from which she did not recover. She passed away peacefully on the 18th of October, as the present issue was being printed.

Margaret Storey was born in San Francisco on the 31st of July, 1900. She was the eldest of the three daughters of Dr. Thomas Storey (and his wife, née Parnie Hamilton), who founded and for many years directed the Department of Health and Athletics of Stanford University. Miss Storey obtained her A.B. degree from Cornell University in 1922, and her A.M. from Stanford in 1936. From 1935 to 1940 she was a volunteer researcher and assistant in the Natural History Museum, and in 1940 was appointed to the Museum's staff, as Associate Curator of Zoological Collections, a post she held until her death.

It is impossible to evaluate or even to estimate Margaret Storey's dedicated services to the Museum. She not only acted as curator, but also as librarian, editor, counsellor, and helpful assistant to everybody—faculty, graduate students, and visiting investigators alike—who worked in the Museum. More than any other person, Margaret Storey kept the zoological section of the Museum in running order. She was a competent ichthyological researcher herself, as her publications testify, but she constantly sacrificed her own interests for those of others.

Although an obituary is being written for publication in Copeia, it has seemed appropriate that the last issue of the Bulletin which she prepared for the press be dedicated to the memory of Margaret Storey.

G. S. M.

LIST OF IMPORTANT ERRATA IN VOL. 7, NO. 4

Page 64. Line 11 from bottom. For Chaw read Shaw.
Page 120. Last line of first paragraph. For Figure 2 read Figure 1.
Page 137. Next to last line. For *sicuphorus* read *sicuephorus*.
Page 140. Third line of last paragraph. For Venezulean read Venezuelan.
Page 175. First paragraph under *Bathydraco wohlschlagi*, for 400 fathoms read 500 fathoms.
Page 180. Seventh line of text. For intraorbital canal read infraorbital canal.
Page 212. Third line of text. For (*senso lato*) read (*sensu lato*).
Page 218. Footnote. For Chalchininae read Chalcininae. For Cheirdontinae read Cheirodontinae. For Rhoadsinae read Rhoadsiinae.
Page 223. Twelfth line of synonymy, for *Gasteropelecus* (no specific name) read *Gasteropleucus* (no specific name).
Page 223. Fourteenth line of synonymy. Transfer whole reference of Cuvier, 1817, to sixteenth line, before Cuvier and Valenciennes. Swainson, not Cuvier, used the spelling *Gasteropelicus*.
Page 234. Bloch 1784 title should read: Oeconomische Naturgeschichte der Fische Deutschlands.
Page 235. Change date of Eigenmann 1922 to 1923.
Page 247. In paragraph beginning "It follows...", change *Conorhynchus* to *Conorhynchos* in all three instances. In same paragraph, the generic name *Potamarius* has been proposed for *C. nelsoni* (see Hubbs and Miller, Copeia, 1960, no. 2, p. 101) since this Bulletin went to press.

A CONTRIBUTION TO THE ICHTHYOLOGY OF NEPAL[1]

By Hugh H. DeWitt

INTRODUCTION

Comparatively little information has been recorded in regard to the fishes of Nepal. Most of what is known is contained in three papers by Regan (1907b), Hora (1937a) and Menon (1949).[2] Recently two collections of Nepalese fishes have been received at the Natural History Museum of Stanford University. The more important of these was obtained by Mr. Alan Cowie Taft while acting as Fisheries Advisor of the United States Operations Mission to Nepal, from September to December, 1955. In addition, specimens from the Kosi System of eastern Nepal were collected by Dr. Lawrence W. Swan in 1954, during the California Himalayan Expedition to Makalu.

The reptiles and amphibians obtained by Dr. Swan have already been reported upon by Leviton, Myers and Swan (1956), who give a map and a list of Dr. Swan's principal collecting stations. The places at which Dr. Swan collected fishes are slightly different from those at which he collected amphibians and reptiles and are therefore listed. Dates mentioned under species headings will identify Dr. Swan's localities, which follow:

March 19, 1954: Arun River west of Chainpur, Nepal. 1000 feet.

March 22, 1954: Above Khāndbāri (Kanbari) east Nepal, in rice field stream. 4500 feet.

March 24, 1954: Small tributary of Arun River, near bridge below Num, east Nepal. 3500 feet.

June 13, 1954: Tributary of Arun River near Num, east Nepal. 3500 feet.

June 20, 1954: Small seasonal stream on ridge above Dhankuta, east Nepal. 6500 feet.

The places at which Mr. Taft obtained fishes are herewith listed:

Station 1: Patan, Nepal: Zoological Gardens pond. Approximate coordinates: Lat. 27° 40′ N; Long. 85° 19.6′ E. Collected by A. C. Taft, September 8, 1955.

Station 2: Kathmandu Valley, Nepal. Approximate coordinates: Lat. 27° 42′ N; Long. 85° 19′ E. Collected by A. C. Taft, September 8-10, 1955.

Station 3: Trisuli (Trusuli) River, Nepal, near Batar bazaar. Collected by Sheppard, September 9, 1955.

Station 4: Trisuli (Trusuli) River, Nepal, near Batar bazaar. Collected by Sheppard, September 10, 1955.

Station 5: Trisuli (Trusuli) River, Nepal, Lidu tributary near Batar bazaar. Collected by Sheppard, September 10, 1955.

Station 6: Godavari Spring, Kathmandu Valley, Nepal. Approximate coordinates: Lat. 27° 35′ N; Long. 85° 23′ E. Collected by A. C. Taft, September 10, 1955.

Station 7: Harisiddhi Village, Kathmandu Valley, Nepal. Approximate coordinates: Lat. 27° 37.5′ N; Long. 85° 21′ E. Purchased by A. C. Taft, September 10, 1955.

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[1]Zoological results of the California Himalayan Expedition to Makalu, Eastern Nepal. II.

[2]Günther (1861) also records a list of fishes from Nepal, but, as it is probable that some of the species were not collected in Nepal, considerable doubt is cast on the locality data for the entire collection (see Day, 1875, p. 81, under *Diagramma cinctum*). It is indicative that Hora (1937a) did not mention Günther's paper in his review of the literature.

Station 8: Bhatgaon (Bhogpaon), Kathmandu Valley, Nepal. Coordinates: Lat. 27° 40.5′ N; Long. 85° 26′ E. Purchased by A. C. Taft, October 19, 1955.

Station 9: Phewa Tal (lake) near Pokhara (Pokhra), Nepal. Coordinates: Lat. 28° 12.5′ N; Long. 83° 57′ E. Collected by A. C. Taft, November 5, 1955.

Station 10: Inlet stream to Phewa Tal (lake) near Pokhara (Pokhra), Nepal. Coordinates: Lat. 28° 13′ N; Long. 83° 55.6′ E. Collected by A. C. Taft, November 5, 1955.

Station 11: Mardi Kola (river) near Pokhara (Pokhra), Nepal. Approximate coordinates: Lat. 28° 17.3′ N; Long. 83° 56.3′ E. Collected by A. C. Taft, November 7, 1955.

Station 12: Phewa Tal (lake) near Pokhara (Pokhra), Nepal. Coordinates: Lat. 28° 12.5′ N; Long. 83° 57′ E. Collected by A. C. Taft, November 8, 1955.

Station 13: Paddy near Pokhara (Pokhra), Nepal. Approximate coordinates: Lat. 28° 14′ N; Long. 83° 59′ E. Collected by A. C. Taft, November 10, 1955.

Station 14: Biratnagar and vicinity, Nepal. Purchased in bazaar. Coordinates: Lat. 26° 27.7′ N; Long. 87° 16.8′ E. Collected by A. C. Taft, November 27-30, 1955.

Station 15: Chatra Morang Province, Nepal, near Biratnagar. Kosi River. Approximate coordinates: Lat. 26° 48′ N; Long. 87° 09.3′ E. Purchased by A. C. Taft, November 28, 1955.

Station 16: Kathmandu Valley, Nepal. Approximate coordinates: Lat. 27° 42′ N; Long. 85° 19′ E. Collected by A. C. Taft, Autumn, 1955.

Station 17: Nepal (no other data). Collected by A. C. Taft, Autumn, 1955.

The fish specimens have been identified by means of the literature and comparison with the relatively extensive collections of Indian fishes at Stanford. Since considerable difficulty was experienced in identifying some species because of the scattered literature, a few notes on the subject may help the next worker. Day's monumental work on Indian fishes (1875-1888) remains the only comprehensive source for the identification of Nepalese fishes. First the specimens were tentatively identified to genera by means of the plates and keys contained in these two volumes. Then Hora and Mukerji (1953) came to my attention, and their tables proved even more useful in identifying the fishes to families (and in some instances to genera and species). A series of papers by Hora and others entitled "Siluroid Fishes of India, Burma, and Ceylon," published in the *Records of the Indian Museum*, constitute a revision of most of the Indian catfishes, and as such supersede Day (op. cit.). Another series of papers by Hora and others entitled "Notes on Fishes in the Indian Museum," published in the same journal, deal with a variety of fishes, including many not covered adequately by Day. In addition, in a series of papers entitled "The Game Fishes of India," published in the *Journal of the Bombay Natural History Society*, Hora clears up the identity and nomenclature of certain catfishes and several species of the genus *Barbus*. Chaw and Shebbeare's "The Fishes of Northern Bengal" (1938) was very helpful with its illustrations and keys. In addition, in the two serials mentioned, there are many reports on collections of fishes from various parts of India, Assam and Burma which include important taxonomic notes.

The present paper concludes with a list of Nepalese fishes. This is based principally on the unpublished report made by Mr. Taft (1955) to the Nepalese Government at the close of his fishery survey, a copy of which has been deposited in the library of the Natural History Museum at Stanford. Taft based his list upon the papers by Hora (1937a) and Menon (1949), and upon the unpublished identifications of Nepalese fishes collected by Mr.

E. C. Migdalski in 1949 for the Peabody Museum of Yale University,[3] and by the Indian Zoological Survey party in 1949. Certain corrections and some rearrangements of the list have been made by Professor G. S. Myers and myself for the present paper.

The synonymies given below for each species include mainly references that clarify identifications and nomenclature. All measurements are in millimeters; length is standard length unless otherwise specified.

I would like to acknowledge the help in the preparation of this paper of Professor George S. Myers of Stanford University, who not only made the collections available to me but guided me in the search through the Indian literature. My thanks go also to Mr. Alan C. Taft and Dr. Lawrence W. Swan, who made the present collections and presented them to Stanford. Mr. Taft also read the introductory part of this paper and corrected a few errors. Miss Margaret Storey of the Natural History Museum was very helpful in calling to my attention odd references in the library. To my fellow students, both past and present, I acknowledge many useful discussions about various problems concerning this paper.

SYSTEMATIC SECTION

Family CYPRINIDAE

Schizothorax sp.

Figures 1 and 2

Stanford University Register Number 52969: Sta. 4; one; 87.9 mm. in standard length.

A single specimen referable to the genus *Schizothorax* was obtained from the Trisuli River in central Nepal. It is close to, if not the same as, the fish described as *Diptychus annandalei* by Regan (1907b). Mukerji (1931) has shown that Regan's specimens are probably young *Schizothorax*. He noted that the specimens have only nine pharyngeal teeth on each side arranged in three rows, while most species of the genus have 10 teeth on each side arranged in three rows. Mukerji also gave a figure of the ventral part of the head of one specimen which shows that the groove behind the lower lip is interrupted in the middle. The right pharyngeal bone of the present specimen bears nine teeth arranged in three rows and the groove behind the lower lip is interrupted in the middle.

Mukerji placed Regan's specimens in the genus *Schizothorax* but was unable to determine whether they belonged to *S. annandalei* or to some other species of *Schizothorax*. It has also not been possible to identify the present specimen with any described form. For the benefit of future workers the accompanying illustrations (Figs. 1 and 2), counts and measurements have been prepared.

Dorsal: iii,8; anal: iii,6; pectoral: i,17; ventral: i,9; caudal: 10/9; lateral line scales: about 99; lateral scales: about 130.

The last unbranched dorsal fin ray is strongly ossified basally and has 15 serrations on its posterior edge. It is segmented and soft at the

[3]The Migdalski collection was sent to Dr. Hora in Calcutta for report, but apparently no paper on it was prepared by Dr. Hora before his death. Dr. Daniel Merriman, Director of the Bingham Oceanographic Laboratory at Yale, writing under the date of April 8, 1958, informs me that the Peabody Museum has been unsuccessful in having the collection returned to Yale from the Indian Museum since Dr. Hora's death.

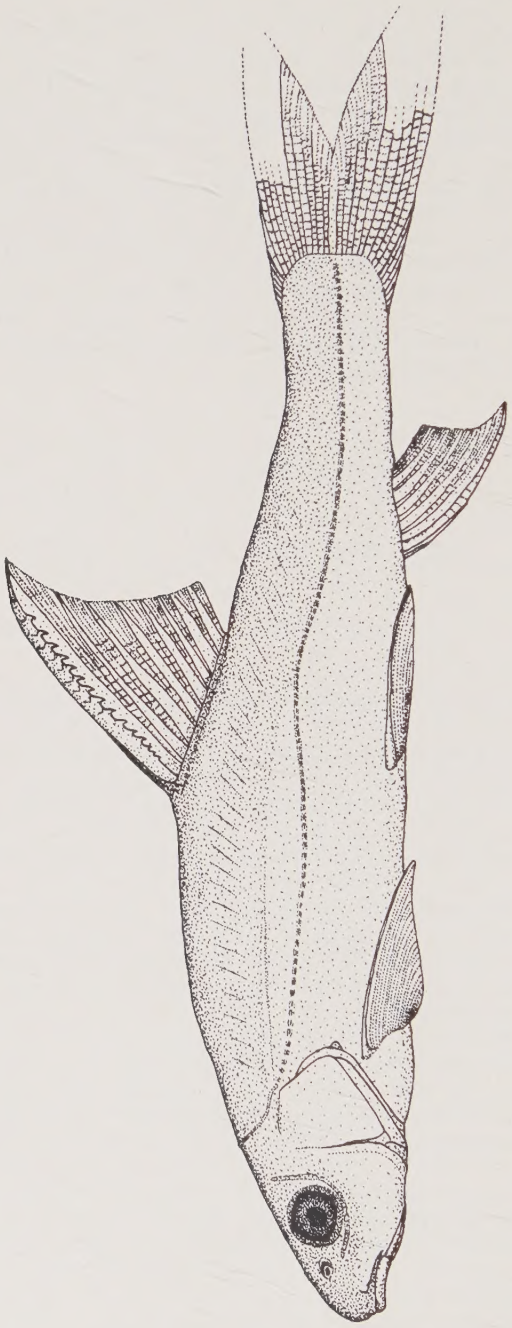

Fig. 1. *Schizothorax* sp. SU 52969, Station 14. Standard length 87.9 mm.

tip. The lateral scales were counted above the lateral line between a vertical from the upper end of the opercular opening and the base of the caudal fin. There are about 12 scales between the midventrum of the caudal peduncle and the lateral line, and the same number above the lateral line to the middorsum of the caudal peduncle.

Standard length, 87.9. Head, 21.8. Head width, 10.8. Height of head on vertical through eye, 10.8. Snout, 7.6. Interorbital width (fleshy), 7.2. Eye, 4.7. Mouth width (from rictus to rictus), 4.8. Maxillary barbels, left, 3.8; right, 4.7. Rostral barbels, left, 4.1; right, 3.9. Body height just anterior to insertion of dorsal fin, 19.0, at insertion of anal fin, 12.6. Least height of caudal peduncle, 8.7. Length of third dorsal fin spine, 25.0. Length of longest anal fin ray, 16.8. Length of longest pectoral fin ray, 16.6. Length of longest ventral fin ray, 15.8. Distance between dorsal fin origin and tip of snout, 45.6. Distance between posterior end of base of dorsal fin and midbase of caudal fin, 33.6. Distance between posterior end of base of anal fin and midbase of caudal fin, 17.9. Anal sheath scales vary in diameter from 0.8-1.2 mm. Pharyngeal teeth, right side, -4,3,2.

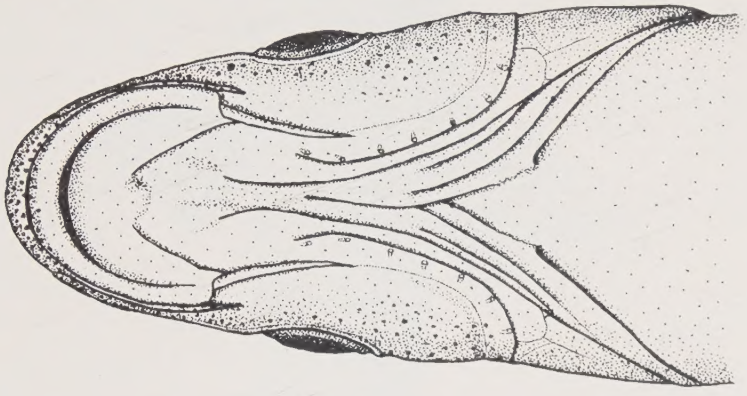

Fig. 2. Ventral view of head of *Schizothorax* sp. SU 52969, Station 14. Standard length 87.9 mm.

All of the fins are colorless except for the basal parts of the dorsal membranes and along the dorsal spines. The body and head are almost uniform in coloration, gray brown above and lighter below. Many faint black streaks are visible, running upward and backward on the dorsal half of the body.

In addition to the specimen discussed above, a number of very small fishes belonging to the genus *Schizothorax* were collected from East Nepal by Dr. Swan. They have been registered as follows: SU 52967: March 19; 35. SU 52968: March 24; 54. They are too small to identify to species.

Oreinus richardsoni (Gray)

Figure 3

Cyprinus richardsonii Gray, 1832, pt. 10, pl. 10, fig. 2 (original illustration and name; no type locality; no types).

Oreinus richardsonii Day, 1877, p. 530, pl. 125, fig. 4 (description; synonymy; illustration).

SU 52904: Sta. 16; four; 71.1-91.5 mm. (92.0-119.5 mm. in total length).

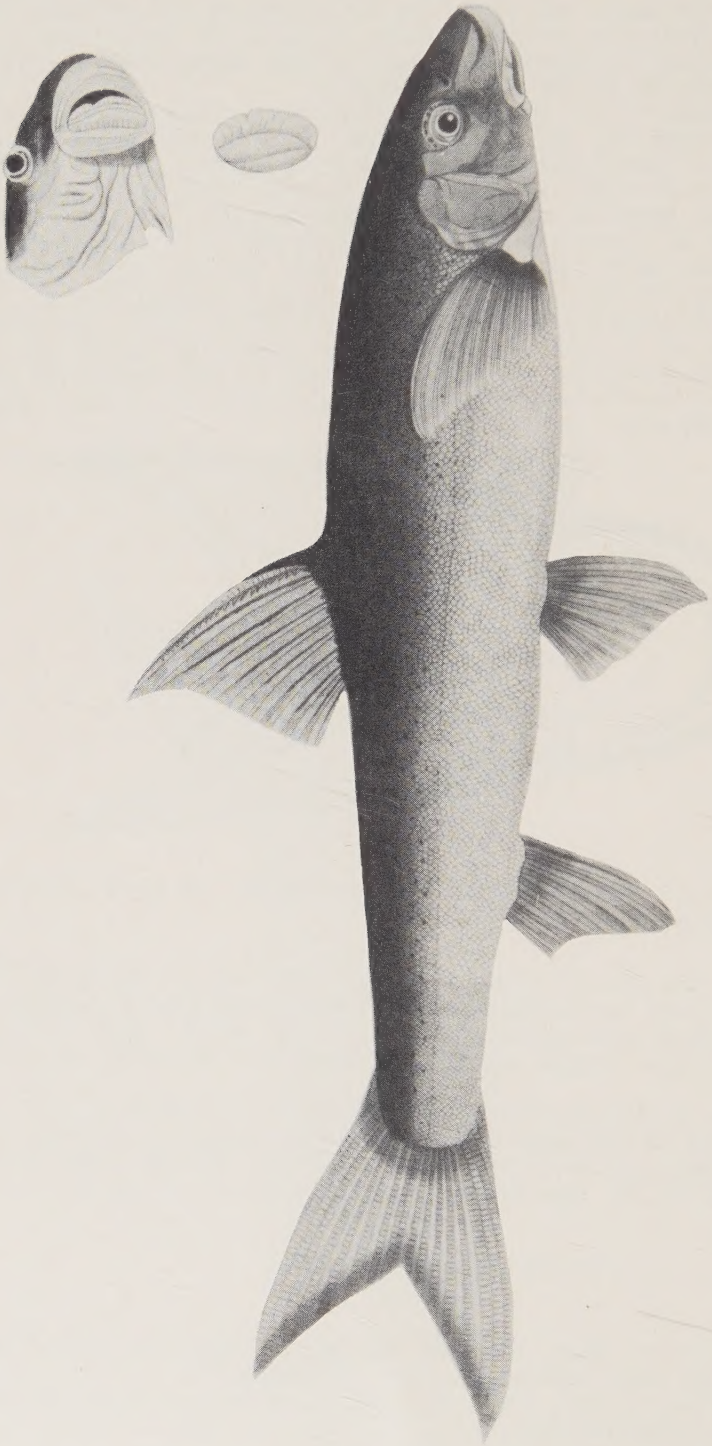

Fig. 3. *Oreinus richardsoni* (Gray). Reproduced from a photograph of the original illustration (Gray, 1832, pt. 10, pl. 10). Gray's fig. 2: lateral view; his fig. 2a: ventral-oblique view of head with enlarged detail of lower lip.

SU 52905: Sta. 6; four; 115.5-157.5 mm. (147-201 mm. in total length). SU 52906: Swan Collection; March 24; five; 36.7-85.3 mm. (48.4-110 mm. in total length).

The identification of these specimens was difficult, and it is based primarily upon the description and illustration by Day (1877, p. 530, pl. 125, fig. 4). Day measured the total length of a specimen rather than the standard length, and some of the proportions he used were based upon this measurement. Therefore, it has been necessary, for comparisons, to use the total length for the proportional measurements of head and caudal fin lengths of the present specimens, although those based on the standard length are also given.

The following characteristics seem to place the present specimens with *Oreinus richardsoni*: lateral line pores 88-108 (83? in one small specimen); anal sheath scales 1.2-2.0 in eye (for large specimens); caudal fin 3.9-4.7 in total length (2.9-3.7 in standard length); head 4.5-5.6 in total length (3.4-4.3 in standard length); eye 1.1-2.3 in snout, and 1.0-2.0 in interorbital width; pharyngeal teeth 2,3,4-4,3,2.

Table 1. Comparison of certain characters of four Indian species of *Oreinus* with those of *O. richardsoni*.

	molesworthi (SU 41189)	*plagiostomus* (SU 41190-SU 41191)	*sinuatus* (SU 34835)	*richardsoni* (SU 52904-SU 52906)
Pharyngeal teeth	-4,3,2	-5,3,2	2,3,5-5,3,2	2,3,4-4,3,2
Anal sheath scales in eye	2.3	-	2.65	1.2-2.0 (large specimens)
Head in total length (SL in parentheses)	6 (4.8)	- -	5.6-5.8 (4.6)	4.5-5.6 (3.4-4.3)
Eye in snout	2.6	-	2.2-2.3	1.1-2.3
Eye in interorbital width	2.3	-	2.0-2.1	1.0-2.0

The Nepal specimens were compared with Indian specimens in the Natural History Museum at Stanford labeled *Oreinus plagiostomus* (SU 41190: Kargil, Ladak; SU 41191: Srinigar, Jhelum R., Kashmir), *O. sinuatus* var. *griffithi* (SU 34835: Chitral), and *O. molesworthi* (SU 41189: eastern Himalayas below Darjeeling). These species, as well as *O. richardsoni*, have all been recorded from the eastern Himalayas by Day (1877, pp. 529-531), Regan (1907b, p. 157), Chaudhuri (1913, pp. 247-248), Hora (1921c, pp. 734-735; 1937a, pp. 43, 44) and others. It should be noted that Misra (1949, pp. 39-40) has placed *O. sinuatus* (Heckel) in the synonymy of *O. plagiostomus* (Heckel). Table 1 gives the pertinent data.

Oreinus richardsoni has been recorded from Nepal by Day (1877, p. 530), Regan (1907b, p. 157), and Hora (1937a, p. 44). The specimens collected by Dr. Swan are the first to be recorded from the Kosi River system in Nepal.

Because it is not generally available, Gray's original illustration of *Oreinus richardsoni* (1832, pt. 10, pl. 10, fig. 2) is reproduced herewith through the courtesy of the owner, Dr. A. E. Leviton (Fig. 3).

Chela bacaila (Hamilton)

Cyprinus bacaila Hamilton, 1822, pp. 265, 384, pl. 8, fig. 76 (original description; type locality: Ganges River system and Peninsular India; no types preserved).
Chela bacaila Day, 1878, p. 603, pl. 152, fig. 5 (description; synonymy; illustration).—Silas, 1951, p. 8 (key, see Silas, 1958).

SU 52907: Sta. 14; one; 62.3 mm. SU 52908: Sta. 15; one; 58.8 mm.

The generic status of the fishes usually assigned to the genus *Chela* Hamilton is in some confusion. Smith (1945, pp. 78-79) and Silas (1958) have restricted the generic limits of *Chela* and the latter author has given a review of the genus. According to Silas' definition *Cyprinus bacaila* Hamilton does not belong in *Chela* and its generic status is therefore uncertain. Silas (ibid., p. 61) indicated that for the time being *Cyprinus bacaila* should be placed in *Oxygaster* van Hasselt. However, since the species does not properly belong there either, and as it has been known for many years as *Chela bacaila*, it seems best to retain the well-known name for the present.

Chela bacaila has been recorded previously from Nepal by Hora (1937a, p. 44) and is known "throughout India except Malabar, Mysore, Madras, and parts of the Deccan" (Day, 1878, p. 603).

Barilius barna (Hamilton)

Cyprinus barna Hamilton, 1822, pp. 268, 384 (original description; type locality: Yamuna and Brahmaputra rivers; no types preserved).
Barilius barna Day, 1878, p. 592, pl. 148, figs. 1, 2 (description; synonymy; illustration).

SU 52909: Sta. 9; six; 44.7-69.75 mm. SU 52910: Sta. 12; seven; 75.7-98.5 mm.

Barilius barna is listed from central and western Nepal by Taft (1955). The present note constitutes the first published record of the species from the country. It is generally common throughout the Ganges River and its branches, and is also found in Orissa, Assam, and Burma (Shaw and Shebbeare, 1938, p. 22).

Barilius bendelisis (Buchanan)

Cyprinus bendelisis Buchanan, 1807, p. 345, pl. 32 (original description; type locality: Vedawáti (Vedāvati) Stream (a headwater of the Kistna River in western Mysore near the town of Heriuru (Hariuru; Hiriyur) in Chatrakal Principality; no types preserved).—Hamilton, 1822, pp. 270, 385 (description; reference).
Barilius bendelisis Day, 1878, p. 590, pl. 148, figs. 7, 8, 9 (description; synonymy; illustrations).

SU 52911: Sta. 5; two; about 63 and 83 mm. SU 52912: Sta. 9; 12; 47.2-82.2 mm. SU 52913: Sta. 12; one; 83.5 mm. SU 52914: Sta. 10; one; 111.3 mm.

This species has been reported from Nepal by Hora (1937a, p. 44) and Menon (1949, p. 232). The latter gives its distribution as "along the base of the Himalayas and throughout the subcontinent of India."

Esomus danrica (Hamilton)

Cyprinus danrica Hamilton, 1822, pp. 325, 390, pl. 16, fig. 88 (original description; type locality: ponds and ditches of Bengal; no types preserved).
Nuria danrica (in part) Day, 1878, p. 583, pl. 145, fig. 7 (illustration applies to *Esomus danrica* only).
Esomus danricus Hora and Mukerji, 1928, p. 49 (revision; synonymy).

SU 52915: Sta. 8; five; 32-41 mm. SU 52916: Sta. 14; one; 36.4 mm.

The specimens from Station 8 are in no condition to be measured accurately, but the characteristics of no lateral line and 14 scales around the caudal peduncle are sufficient for identification (Hora and Mukerji, 1928, pp. 42, 49-53).

Inasmuch as the specific name *danrica* is an unlatinized transliteration of a native Hindi name for the fish, and is thus used as a substantive in apposition with the generic name, its termination should not be changed (as if it were a Latin word) to agree in gender with the generic name *Esomus*. It should remain *danrica*, no matter what the generic name may be.

Esomus danrica has not been recorded previously from Nepal, although Taft (1955) lists it from the central and western parts of the country. It is common in the ditches and ponds of Bengal, Bihar, Orissa, Assam, United Provinces, Central Provinces and the Punjab, and is also found in South India (Hora and Mukerji, 1928, p. 50).

Aspidoparia jaya (Hamilton)

Cyprinus jaya Hamilton, 1822, pp. 333, 392 (original description; type locality: rivers of northern Bihar; no types preserved).
Aspidoparia jaya Day, 1878, p. 585, pl. 145, fig. 9 (description; synonymy; illustration).

SU 52918: Sta. 14; one; 69.5 mm.

Aspidoparia jaya has been recorded from Nepal by Hora (1937a, p. 44) and Menon (1949, p. 232) and is known from "Hardwar on the Ganges and Assam" (Day, 1878, p. 586).

Aspidoparia morar (Hamilton)

Cyprinus morar Hamilton, 1822, pp. 264, 384, pl. 31, fig. 75 (original description; type locality: Yamuna and Tista rivers; no types preserved).
Aspidoparia morar Day, 1878, p. 585, pl. 146, fig. 4 (description; synonymy; illustration).

SU 52917: Sta. 14; two; 63.9 and 68.1 mm.

Hora (1937a, p. 44) and Menon (1949, p. 232) have recorded this species from Nepal. Day (1878, p. 585) gives its distribution as Sind, Punjab, most of the continent of India, Assam and Burma.

Genus *BARBUS* Cuvier

Myers (1960) has given good reasons for the retention of the generic

name *Barbus* in a broad sense, rather than the utilization of *Puntius* and other names for generic segregates of *Barbus* in areas in which a thoroughgoing and complete revision has not yet been attempted.

Barbus chaĝunio (Hamilton)

Cyprinus chaĝunio Hamilton, 1822, pp. 295, 387 (original description; type locality: Yamuna River and northern rivers of Bihar and Bengal; no types preserved).

Barbus chaĝunio Day, 1878, p. 559, pls. 136, fig. 1 and 140, fig. 2 (description; synonymy; illustrations).—Hora and Mukerji, 1933, p. 137, figs. 1, 2 (sexual dimorphism; synonymy; illustrations).

SU 52919: Sta. 12; three; 101.3 to about 179 mm. SU 52920: Sta. 14; two; 101.2 and 103.2 mm.

This is the first published record of *Barbus chaĝunio* from Nepal although Taft (1955) lists it from the central and western parts of the country. Day (1878, p. 560) gives its distribution as "from Orissa, throughout Bengal, Assam, Behar, and the N. W. Provinces to the Punjab...."

Barbus chola (Hamilton)

Cyprinus chola Hamilton, 1822, pp. 312, 389 (original description; type locality: ponds and stagnant waters of northeastern parts of Bengal; no types preserved).

Barbus chola Day, 1878, p. 571, pl. 142, fig. 4 (description; synonymy; illustration).

SU 52921: Sta. 14; one; 53.3 mm.

Barbus chola has been recorded from Nepal by Menon (1949, p. 232) who gives its distribution as "India, Burma, and further east."

Barbus hexaĝonolepis M'Clelland

Barbus hexaĝonolepis M'Clelland, 1839, pp. 270, 313, 336, pl. 41, fig. 3 (original description; type locality: upper Assam; type specimens probably not in existence).—Day, 1878, p. 564, pl. 137, fig. 4 (description; illustration).

Barbus dukai Day, 1878, p. 564, pl. 143, fig. 3 (original description; type locality: Teesta River, Darjeeling; type specimens in Day's collection in Calcutta, London or Sydney).

Barbus (Lissochilus) hexaĝonolepis Hora, 1940 (history; nomenclature; description; synonymy; distribution; illustrations); 1941b, p. 811, fig. 2 (key; illustration).

SU 52922: Swan Collection; March 24; one; 52.1 mm. SU 52923: Sta. 10; three; about 88 to 99 mm.

In regard to the referral of this species to *Lissochilus*, see Myers, 1941 and 1960.

Hora (1940, p. 86) and Menon (1949, p. 233) have recorded *Barbus hexaĝonolepis* from Nepal. The three specimens from Station 10 may be the first to be recorded from central Nepal, as Hora does not state from what part of the country his specimens came, and Menon's were from eastern Nepal. The species is found throughout the eastern Himalayas, Assam, Burma and further east.

Barbus putitora (Hamilton)

Cyprinus putitora Hamilton, 1822, pp. 303, 388 (original description; type locality: eastern parts of Bengal; no types preserved).
Barbus tor (part) Day, 1878, p. 564, pl. 136, fig. 5 (illustration applies to *B. putitora* only).
Barbus putitora Hora and Mukerji, 1936, pp. 140, 141, fig. 2 (mouth variation; illustration).
Barbus (Tor) putitora Hora, 1939 (nomenclature; history; description; distribution).

SU 52924: Sta. 10; two; about 102 and 114 mm. SU 52925: Sta. 12; one; 98.2 mm.

Barbus putitora is common all along the Himalayas and has been recorded from Nepal by Hora (1937a, p. 44) and Menon (1949, p. 233).

Barbus sarana (Hamilton)

Cyprinus sarana Hamilton, 1822, pp. 307, 388 (original description; type locality: ponds and rivers of India (name in Bengal: Sarana pungti); no types preserved).
Barbus sarana Day, 1878, p. 560, pl. 136, figs. 2, 2a (description; synonymy; illustration).

SU 52926: Sta. 14; two; 93.9 and 112.9 mm.

Barbus sarana has been recorded from Nepal by Menon (1949, p. 232) and is known from India, Burma and Yunnan.

Barbus sophore (Hamilton)

Cyprinus sophore Hamilton, 1822, pp. 310, 389, pl. 19, fig. 86 (original description; type locality: ponds in the Ganges River area; no types preserved).
Leuciscus stigma Cuvier and Valenciennes, 1844, p. 93, pl. 489 (original description; type locality: Mysore; type in Paris).
Barbus stigma Day, 1878, p. 579, pl. 141, fig. 5 (description; synonymy; illustration).
Barbus sophore Chaudkuri, 1916, p. 436 (nomenclature; synonymy).

SU 52927: Sta. 14; three; 51.5-52.5 mm. (one specimen not measurable). SU 52928: Sta. 1; one; 73.5 mm.

Chaudhuri (1916, p. 436) states that the confusion surrounding the identity of Hamilton's *Cyprinus sophore* has been due to "printer's mistakes" in the original description. On this basis he corrects Hamilton's description and places *Leuciscus stigma* Cuvier and Valenciennes in synonymy. Raj (1916, pp. 256-258) also concludes that *Leuciscus stigma* is a synonym of *Cyprinus sophore*, but for reasons which do not bear on the problem, and which are subject to some doubt. His conclusions that Hamilton's *Cyprinus sophore* is the same as the fish Day (1878, p. 566, pl. 143, fig. 4) described as *Barbus sophore* I believe to be incorrect. Day's species should therefore be called by some other name.

Barbus sophore has been recorded from Nepal by Menon (1949, p. 232) and is known from India, Burma and Yunnan. The data enclosed with the specimen from Station 1 includes the comment by Mr. Taft that the fish was probably introduced.

Barbus sp.

Two lots of small specimens of *Barbus* which have not been identified were collected by Dr. Swan from eastern Nepal. They have been registered as follows: SU 53153: March 19; one. SU 53154: March 24; 18.

Cirrhinus reba (Hamilton)

Cyprinus reba Hamilton, 1822, pp. 280, 386 (original description; type locality: rivers and ponds of Bengal and Bihar; no types preserved).
Cirrhina reba Day, 1877, p. 549, pl. 130, fig. 3 (description; synonymy; illustration).

SU 52929: Sta. 14; six; 64.4-77 mm.

I follow Smith (1945, p. 161) in using the generic name *Cirrhinus* rather than *Cirrhina*.

Menon (1949, p. 233) has recorded *Cirrhinus reba* from Nepal. It is known from India and Thailand.

Garra annandalei Hora

Garra annandalei Hora, 1921b, p. 657 (original description; type locality: Assam and the Darjeeling Himalayas; type specimen in Calcutta).

SU 52930: Sta. 17; three; 69-72.5 mm.

The present specimens were identified with the help of the key in Hora's revision of the Indian species of *Garra* (Hora, 1921b, pp. 649-651). The characters which separate *Garra annandalei* from other members of the genus are: barbels present (four in this species); eyes situated in the posterior half of the head (I measured from the tip of the snout to the posterior border of the bony opercle); proboscis absent; tubercular areas on the snout absent (very few tubercles on the present specimens). The following is a summary of the proportions: head 4.2-4.45 in standard length; head width 1.2-1.3 in head length; eye 5.0-5.5 in head; eye 2.5-2.8 in snout; eye 2.5-2.6 in interorbital width; longitudinal diameter of mental disk 1.7-2.0 in its transverse diameter.

Garra annandalei has been recorded from eastern Nepal by Menon (1949, p. 233) and is otherwise known only from the Darjeeling Himalayas and Assam. It is unfortunate that the data with the present specimens have been lost and that the precise locality in Nepal from which they were collected cannot now be ascertained.

Garra lamta (Hamilton)

Cyprinus lamta Hamilton, 1822, pp. 343, 393 (original description; type locality: Kharagpur Hills (as restricted by Hora, see below); no types preserved).
Garra lamta Hora 1937c, p. 344, figs. 9-10 (description; discussion of type locality; synonymy; illustrations).

SU 52931: Sta. 5; two; 57.5 and 60.3 mm.

These two specimens were identified with the aid of the key in the re-

vision of the genus *Garra* by Hora (1921b, pp. 649-651) and the description and illustrations in a later paper by the same author (1937c, pp. 345-347) in which he clears up the confusion between the present species and *Garra gotyla* (Gray). However, there are some discrepancies between the Nepal specimens and the descriptions in the above two papers. The characteristics of the present specimens are as follows: anal fin origin equidistant between caudal fin base and anterior origins of ventral fins instead of nearer to base of caudal fin; ventral fins reach a little beyond the anus instead of to the anus; distance between anus and anal fin origin one third distance between origins of anal and ventral fins, instead of less than one third distance between the origins of anal and ventral fins. There is no obvious longitudinal stripe ending with a blackish spot at the base of the caudal fin, although there are faint markings which might represent the stripe and spot. The upper part of the body, including the sides, is dark. The ventrum is abruptly whitish.

This is the first record of *Garra lamta* from Nepal, although Taft (1955) includes it in his list. It is otherwise known only from the Kharagpur Hills (see Hora, 1937c).

Garra sp.

Two lots of small specimens belonging to the genus *Garra* were found among the fishes collected in Nepal by Mr. Taft. They may be juveniles of *Garra lamta*, as all of them show a faint lateral stripe and a faint spot at the base of the caudal fin. One lot, SU 52932, from Station 8, consists of three specimens 27-30 mm. in standard length. The other lot, SU 52933, from Station 11, is of eight even smaller specimens, not well preserved.

Labeo bata (Hamilton)

Cyprinus bata Hamilton, 1822, pp. 283, 386 (original description; type locality: rivers and ponds of Bengal; no types preserved).
Labeo bata Day, 1877, p. 542, pl. 129, fig. 5 (description; synonymy; illustration.

SU 52934: Sta. 14; three; 64.6-70.5 mm.

The following characters identified these specimens as *Labeo bata*: lateral line scales 42-44; a dark spot on the scale above the fourth lateral line scale; lower lip a fimbriate flap behind the covering of the lower jaw; no lateral lobes to snout; a few glands on upper part of snout; eye closer to snout tip than to posterior edge of opercle. Three specimens (SU 41166; Fish Market, Tozpur, Assam) labeled *Labeo bata* had lateral line counts from 39 to 44 and each had a spot on the scale above the fourth lateral line scale.

Labeo bata has not been recorded previously from Nepal, although it is listed by Taft (1955), who indicates that it has been introduced into the Kathmandu Valley. Day (1877, p. 542) states that the species is known from the Kistna and Godavery rivers, through Orissa, Lower Bengal and Assam, and that it is used extensively for stocking tanks. It is possible that it may have been introduced into eastern Nepal for this purpose.

Labeo boga (Hamilton)

Cyprinus boga Hamilton, 1822, pp. 286, 386, pl. 28, fig. 80 (original description; type locality: Brahmaputra River; no types preserved).

Labeo boga Day, 1877, p. 543, pls. 128, fig. 3 and 131, fig. 4 (description; synonymy; illustrations).

SU 52935: Sta. 14; one; 89.6 mm. (120 mm. in total length).

The following characters identify this specimen: no lateral lobes to snout; 39 lateral line scales; caudal fin 2.9 in standard length (3.9 in total length). Four Indian specimens labeled *Labeo boga* (SU 34582, Calcutta, and SU 41167, Chingleput, Madras Presidency) gave the following data: no lateral lobes to snout; 39 lateral line scales; caudal fin 2.9-3.4 in length (3.9-4.4 in total length).

Labeo boga has been recorded previously from Nepal by Menon (1949, p. 233), and is known throughout India and Burma.

Labeo dero (Hamilton)

Cyprinus dero Hamilton, 1822, pp. 277, 331, 385, pl. 22, fig. 78 (original description; type locality: Brahmaputra River; no types preserved).

Labeo diplostomus Day, 1877, p. 540, pl. 129, fig. 2 (description; synonymy; illustration).

Labeo dero Hora and Mukerji, 1936, p. 142, fig. 3 (synonymy; mouth characters; illustration).—Hora, 1936b, p. 320, figs. 2a, 3a (differentiation from *Labeo dyocheilus*; illustrations).

SU 52936: Sta. 14; one; 76.1 mm.

The present specimen shows the characteristics set forth by Hora (1936b, pp. 320-324) for *Labeo dero*, namely: tubercles present on dorsal surface of free lower lip; few pearl organs on snout; a shallow groove across snout; no lateral lobe to snout. These characters serve to distinguish *L. dero* from *L. dyocheilus* (M'Clelland).

Labeo dero has been recorded previously from Nepal by Hora (1937a, p. 44) and Menon (1949, p. 233). The latter gives the distribution of the species as "all along the Himalayas, Sind Hills, Assam, and Burma."

Labeo dyocheilus (M'Clelland)

Cyprinus dyocheilus M'Clelland, 1839, pp. 268, 330, pl. 37, fig. 1 (original description; type locality: Assam; type specimens probably not in existence).

Catastomus dyocheilus M'Clelland, 1839, p. 311 (in error, for *Cyprinus dyocheilus*, in explanation of pl. 37, fig. 1).

Labeo dyocheilus Hora, 1936b, p. 320, figs. 1, 2b, 3b (synonymy; differentiation from *Labeo dero*; illustrations).

SU 52937: Sta. 14; four; 86.9-101.1 mm.

The following characters serve to separate *Labeo dyocheilus* from *L. dero* (Hamilton) (Hora, 1936b, pp. 320-324): many pearl organs on snout; lateral lobes to snout; no groove across snout; a series of ridges on dorsal surface of free lower lip.

Labeo dyocheilus has been recorded previously from Nepal by Hora (1937a, pp. 44, 45) and Menon (1949, p. 233), and according to the latter, is known from "all along the Himalayas, Sind Hills, Assam, and Burma."

Family COBITIDAE

Lepidocephalus guntea (Hamilton)

Cobitis guntea Hamilton, 1822, pp. 353, 394 (original description; type locality: ponds and fresh rivers of Bengal; no types preserved).
Lepidocephalichthys guntea Day, 1878, p. 609, pls. 155, fig. 4 and 156, fig. 12 (description; synonymy; illustrations).
Lepidocephalichthys annandalei Chaudhuri, 1912, p. 442, pl. 40, figs. 3, 3a, 3b (original description; type locality: Mahananda River at Siliguri, and Tista River near Jalpaiguri; type specimens in Calcutta).
Lepidocephalus guntea Hora and Gupta, 1941, p. 81 (synonymy; color notes).

SU 52938: Sta. 14; three; 52.0-59.7 mm. SU 52939: Sta. 15; two; both 65 mm.

The specimens all have about 25 to 30 scale rows between the anal fin and the back. Sehgal (1959, p. 149) states that his specimen of *Lepidocephalus berdmorei* (Blyth) had 38 scale rows between its anal fin and the back, and Day (1878, p. 610) states there are "about 40 rows" for that species. Other counts and proportions did not help to separate the species, nor did comparison of the Nepal specimens with the Indian material in the Stanford Collections.

Lepidocephalus guntea has been recorded previously from Nepal by Menon (1949, p. 234), who gives its distribution as throughout northern India. It might be mentioned that Hamilton (1822, p. 356) states that *Cobitis balgara* (= *Cobitis guntea*) is found in the Kosi River, but does not say from what part. It is most likely that his examples came from northern Bihar Province.

Nemacheilus rupecula (M'Clelland)

Schistura rupecula M'Clelland, 1838, p. 948, pl. 55, figs. 3, 3a, 3b (original description; type locality: mountain streams at Simla; type specimens probably not in existence); 1839, pp. 309, 441, pl. 57, fig. 3 (reference).
Nemachilus rupecola Günther, 1868, p. 351 (reference).
Nemacheilus rupicola Day, 1878, p. 616, pl. 153, fig. 9 (description; synonymy; illustration).
Nemacheilis rupecola var. *inglisi* Hora, 1935, p. 58, pl. 3, figs. 9, 10 (original description; type locality: eastern Himalayas, rivers below Darjeeling and in Sikkim; type specimen in Calcutta).

SU 52940: Swan Collection; June 20; one; 57.0 mm. SU 52941: Swan Collection; June 13; two; 24.09 and 31.91 mm. SU 52942: Swan Collection; March 24; five; 37-65 mm. SU 52943: Swan Collection; March 21; 23; 19.2-32.2 mm. SU 52944: Sta. 8; eight; 33.5-42.3 mm.

All of the specimens have the nasal barbels and body bars characteristic of *Nemacheilus rupecula* (Hora, 1935, pp. 58-60). Evidently due to different methods of preservation or to bleaching, some of the specimens are faded and soft, while others are hardened and show the body bars clearly. The specimens numbered SU 52941 are delicate and transparent. The

Station 8 specimens (SU 52944) had evidently lain in the sun for some time before Taft purchased them, as they are faded and bent.

The use of the specific name *rupecula* for this species has been questioned as being an error by M'Clelland, who supposedly intended to use *rupicola*. However, M'Clelland used *rupecula* both in 1838 and in 1839, which should indicate that he intended to use the name. Nevertheless, some clarification is needed to determine its validity.

In his original description, M'Clelland (1838, p. 948) did not define *rupecula*, and there is nothing in the description to indicate that he intended to use *rupicola* rather than *rupecula*. Brown (1954, pp. 673, 757) defines *rupecula* as little rock, or the diminutive of *rupes*, rock. The word *rupicola* is a combination of *rupes* and *-cola* (Brown, ibid., pp. 217, 478), the latter being a combining form meaning dweller or inhabitant. The combining form of *rupes* is the stem, *rup-* plus *i* (Brown, ibid., p. 22) making *rupi-*, which, when combined with *-cola*, gives *rupicola*, meaning an inhabitant of a stone. Therefore, since *rupecula* is a correct Latin noun and its use does not violate the International Rules of Zoological Nomenclature, and since it seems evident that M'Clelland intended to use it, I feel that *rupecula* should stand as the correct specific name for *Schistura rupecula* M'Clelland. Günther (1868, p. 351) was the first to emend *rupecula*, but he erred in using "*rupecola*." Day (1878, p. 616) corrected Günther's mistake, and used "*rupicola*," which is the correct combination form. However, several later authors have perpetuated Günther's error.

Nemacheilus rupecula has been recorded previously from Nepal by Menon (1949, p. 234), and is known from throughout northern India.

Family SILURIDAE

Ompok bimaculatus (Bloch)

Silurus bimaculatus Bloch, 1794, p. 24, pl. 364 (original description; type locality: Malabar coast; types probably in Berlin).
Callichrous bimaculatus Hora, 1936c, p. 356 (history; nomenclature; synonymy).
Ompok bimaculatus Haig, 1951, pp. 83, 103 (history; nomenclature; synonymy).

SU 52945: Sta. 14; six; 75.5-91 mm.

Ompok bimaculatus has been discussed in detail with full synonymies by Hora (1936c, pp. 356-361) and Haig (1951, pp. 83-91, 103-105). Both give a history of the genus *Ompok* and its synonyms.

This species has been recorded previously from Nepal by Menon (1949, p. 234), and is known throughout India and further east.

Family BAGRIDAE

Mystus vittatus (Bloch)

Silurus vittatus Bloch, 1794, p. 50, pl. 371, fig. 2 (original description; type locality: Tranquebar; type specimens probably in Berlin).
Macrones vittatus Day, 1877, p. 448, pl. 99, fig. 4 (description; synonymy; illustration).

Mystus vittatus Fowler, 1928, p. 105 (nomenclature; color notes).—Jayaram, 1954, p. 534, fig. 3 (description; synonymy; illustration).

SU 52946: Sta. 14; 11; 46-70 mm.

Fowler (1928, p. 105) and Hora and Mukerji (1934, p. 355) have discussed the use of the generic name *Mystus*. Jayaram (1954) has reviewed the Indian species of *Mystus*, and presents a key to them.

Mystus vittatus has not been recorded from Nepal, although Taft (1955) includes it in his list. Jayaram (op. cit., p. 535) gives the distribution of this species as "throughout India, Burma, Siam, and Ceylon."

Family SCHILBEIDAE

Clupisoma montana Hora

Clupisoma montana Hora, 1937b, p. 673, figs. 2c, 3c, 7, 8, 9 (original description; type locality: Teesta River, below Darjeeling; type specimen in Calcutta).

SU 52947: Sta. 3; one; 199 mm. SU 52948: Sta. 4; one; 159.9 mm.

In a review of the genus *Clupisoma* Swainson, Hora (1937b, pp. 673-676) described a new species, *C. montana*, from the Teesta River, below Darjeeling. It was characterized by having the abdominal edge rounded throughout, the nasal barbels extending beyond the front margins of the eyes, the anal fin rays 41-43 in number, and having, in the adult, an adipose dorsal fin. The present specimens agree with Hora's description with respect to the last three characters, but it is possible that each might have had a keeled abdominal edge between the ventral and anal fins when alive (both specimens are bent and it is therefore difficult to be sure whether or not a sharp ridge did exist). The presence of an adipose dorsal fin and 42 anal rays clearly separate them from *Clupisoma garua* (Hamilton), the only other species described from northern India (*C. prateri* Hora is known only from Burma, and not only has a very prominent keeled abdominal edge, but also lacks an adipose fin in the adult). The only other species with which *Clupisoma montana* might be confused is *Eutropiichthys murius* (Hamilton). However, the present specimens have the following characters which separate them from the latter species: tooth bands not produced backwards at the sides; the gape of the mouth does not reach to below the eye; a deep scallop in the membrane of the subopercle.

The present specimens are apparently the first to be recorded from Nepal; and, to my knowledge, this is the first record of the species since the original description.

Pseudeutropius atherinoides (Bloch)

Silurus atherinoides Bloch, 1794, p. 48, pl. 371, fig. 1 (original description; type locality: Malabar coast; type specimens probably in Berlin).

Pseudeutropius acutirostris Day, 1869, p. 618 (original description; type locality: throughout Burma; type specimens in Day's collection in Calcutta, London or Sydney); 1877, p. 472, pl. 109, fig. 1 (description; illustration).

Pseudeutropius atherinoides Day, 1877, p. 473, pl. 109, fig. 2 (description; synonymy; illustration).—Hora, 1941a, p. 103, figs. 2 (a, b, c, d, h), 3 (synonymy; illustrations).

SU 52949: Sta. 14; nine; 33.5-41.5 mm.

Hora (1941a, pp. 100-105) has discussed the generic limits of *Pseudeutropius* and the nomenclature of the two Indian species. The following is a summary of the measurements and proportions for the Nepal specimens: nasal barbels longer than head; head 3,9-4.4 in length (5.1-5.8 in total length); caudal fin 3.0-3.8 (4.0-4.8); body height 3.9-4.4 (5.2-5.7). Day (1877, p. 473) gives the following in his description of *Pseudeutropius sykesii* (*nec* Jerdon) (= *P. mitchelli* Günther): nasal barbels reach to front edge of orbit; head, caudal fin and body height all 6 in the total length. Thus it is clear that the Nepal specimens belong to Bloch's rather than to Günther's species.

The present specimens are the first to be recorded from Nepal. Day (op. cit., p. 474) gives the distribution of the species as Sind, India (except the western coast) and Assam.

Family HETEROPNEUSTIDAE

Heteropneustes fossilis (Bloch)

Silurus fossilis Bloch, 1794, p. 46, pl. 370, fig. 2 (original description; type locality: Tranquebar; type probably in Berlin).
Saccobranchus fossilis Day, 1877, p. 486, pl. 109, fig. 1 (description; synonymy; illustration).
Heteropneustes fossilis Hora, 1936a, p. 208 (history; nomenclature).

SU 52950: Sta. 8; four; 44.6-55.4 mm. SU 52951: Sta. 5; one; 75.5 mm.

Hora (1936a, pp. 208-209) gives a history of the genus *Heteropneustes*, and concludes that there are only two species referable to it (there are three if *H. kemratensis* (Fowler) from Thailand is really different from *H. fossilis*). The second, *Heteropneustes microps* (Günther) is known only from Ceylon.

Heteropneustes fossilis has been recorded previously from Nepal by Regan (1907b, p. 158), and is known from India and Burma to Cochin China.

Family BELONIDAE

Xenentodon cancila (Hamilton)

Esox cancila Hamilton, 1822, pp. 213, 380, pl. 27, fig. 70 (original description; type locality: ponds and smaller rivers of the Gangetic provinces; no types preserved).
Belone cancila Day, 1877, p. 511, pl. 118, fig. 5 (description; synonymy; illustration).
Xenentodon cancila Shaw and Shebbeare, 1938, p. 108, fig. 112, pl. 4, fig. 15 (reference; illustrations).—Smith, 1945, p. 427 (reference).

SU 52952: Sta. 9; one; 171.1 mm. SU 52953: Sta. 12; one; 176 mm. SU 52954: Sta. 14; two; about 172 and 179 mm. (tips of beaks of both

specimens are broken).

Xenentodon cancila has been recorded previously from Nepal by Hora (1937a, p. 44) and Menon (1949, p. 235), and is known from India, Ceylon, Burma, Thailand and Malaya.

Family GOBIIDAE

Glossogobius giuris (Hamilton)

Gobius giuris Hamilton, 1822, pp. 51, 366, pl. 33, fig. 15 (original description; type locality: ponds and fresh-water rivers of the Gangetic provinces; no types preserved).—Day, 1876, p. 294, pl. 66, fig. 1 (description; synonymy; illustration).

Glossogobius giuris Koumans, 1941, p. 256 (description; synonymy); 1953, p. 165, figs. 39, 40 (description; synonymy; illustrations).

SU 52955: Sta. 14; one; 80.8 mm. SU 52956: Sta. 15; two; 76.4 and 86 mm.

Glossogobius giuris has been recorded previously from Nepal by Menon (1949, p. 235). It is a very widely distributed fish, found from the east coast of Africa to Australia and the Pacific Islands as well as throughout the fresh waters of India.

Family CHANNIDAE

Channa orientalis Bloch and Schneider

Channa orientalis Bloch and Schneider, 1801, p. 496, pl. 90, fig. 2 (original description; type locality: "India orientali"; type specimens probably in Berlin).—Day, 1876, p. 368, pl. 78, fig. 2 (description; illustration).—Myers and Shapovalov, 1931, p. 33 (nomenclature).—Shapovalov, 1932, p. 123, pl. 2 (nomenclature; description; synonymy; illustration).

Ophiocephalus gachua Hamilton, 1822, pp. 68, 367, pl. 21, fig. 21 (original description; type locality: ponds and ditches of Bengal; no types preserved);—Day, 1876, p. 367 (description; synonymy).

Ophiocephalus harcourt-butleri Annandale, 1918, p. 54, fig. 2, pls. 2, fig. 7 and 4, figs. 16, 17 (original description; type locality: Fort Stedman, a town on the shore of Inlé Lake, Burma; type specimen in Zoological Survey of India, Calcutta).

Channa burmanica Chaudhuri, 1919, p. 284, pl. 22, fig. 4 (original description; type locality: River Sen-Bin-Ti, upper Irrawaddy system, northern Burma; type in Zoological Survey of India, Calcutta).

Channa gachua Myers and Shapovalov, 1931, p. 33 (nomenclature).

SU 52957: Sta. 7; 45; 28.8-111.4 mm. SU 52958: Sta. 2; four; 52.1-85.6 mm. SU 52959: Sta. 5; one; 48.1 mm. SU 52960: Sta. 8; one; 33.7 mm. SU 52961: Sta. 13; seven; 53.6-94 mm.

Myers and Shapovalov (1931) have shown that the genus *Ophicephalus* Bloch is a synonym of *Channa* Scopoli. In his unpublished thesis on Formosan fishes, a fuller discussion is given by Shapovalov (1932), who definitely synonymizes *gachua* with *orientalis*. Myers (1944, p. 600) has

also pointed out that the type species of *Channa*, *C. orientalis*, is composed of individuals of *"Ophicephalus gachua"* lacking pelvic fins as an anomaly, and therefore *gachua* and *orientalis* are the same species. The name *orientalis* (of 1801) takes precedence over the name *gachua* (of 1822). At the request of Professor Myers, the types of the names *Channa burmanica* Chaudhuri and *Ophiocephalus harcourt-butleri* Annandale were examined by the late Dr. Hora, who pronounced them (in litt.) to be examples of *"O. gachua"*. Myers (1944; 1946) has discussed the problem of the anomalous absence of pelvic fins, and gives references to the literature.

Channa orientalis has not been recorded previously from Nepal, although Taft (1955) includes it in his list. It is known from India, Ceylon, Burma, Yunnan, the Andaman Islands, Hainan and Formosa.

Channa punctata (Bloch)

Ophicephalus punctatus Bloch, 1793, p. 139, pl. 358 (original description; type locality: rivers and lakes of the Coromandel coast; types probably in Berlin).
Ophiocephalus punctatus Day, 1876, p. 367, pl. 78, fig. 1 (description; synonymy; illustration).
Channa punctata Myers and Shapovalov, 1931, p. 35 (listed).

SU 52962: Sta. 14; two; 105.8 and 127 mm.

Channa punctata has been recorded previously from Nepal by Regan (1907b, p. 158), Hora (1937a, p. 44) and Menon (1949, p. 235). It is known from India, Burma, Ceylon and Yunnan.

Family ANABANTIDAE

Colisa fasciata (Bloch and Schneider)

Trichogaster fasciatus Bloch and Schneider, 1801, p. 164, pl. 36 (original description; type locality: Tranquebar; types probably in Berlin). —Day, 1877, p. 374, pl. 78, fig. 6 (description; synonymy; illustration).
Colisa fasciata Myers, 1923, p. 112 (synonymy; nomenclature).

SU 52963: Sta. 14; two; 46.2 and 58.2 mm.

This species has been recorded previously from Nepal by Menon (1949, p. 234) and is known from northern India, Assam and Burma.

Family NANDIDAE

Nandus nandus (Hamilton)

Coius nandus Hamilton, 1822, pp. 96, 370, pl. 30, fig. 32 (original description; type locality: ponds of the Gangetic provinces; no types preserved).
Nandus marmoratus Day, 1875, p. 129, pl. 32, fig. 1 (description; synonymy; illustration).

Nandus nandus Smith, 1945, p. 488 (reference).

SU 52964: Sta. 15; four; 65.2-80.8 mm.

Nandus nandus has not been recorded previously from Nepal, although Taft (1955) lists it. It is known from India, Burma and Thailand.

Family MASTACEMBELIDAE

Macrognathus aculeatus (Bloch)

Ophidium aculeatum Bloch, 1786, p. 72, pl. 159, fig. 2 (original description; type locality: "Ostindien"; types probably in Berlin).

Rhynchobdella aculeata Day, 1876, p. 338, pl. 72, fig. 1 (description; synonymy; illustration).

Macrognathus aculeatus Sufi, 1956, p. 101, pl. 18, figs. 7-10 (revision; synonymy; illustrations).

SU 52965: Sta. 14; four; 119-162.3 mm.

The present specimens have the characteristic ocelli along the base of the dorsal fin, and are olive gray above and pale yellowish below. The species is found from India eastward to the Greater Sunda Islands and the Moluccas. These are apparently the first specimens to be recorded from Nepal.

Family AMPHIPNOIDAE

Amphipnous cuchia (Hamilton)

Unibranchapertura cuchia Hamilton, 1822, pp. 16, 363, pl. 16, fig. 4 (original description; type locality: rivers and ponds of the south-east parts of Bengal; no types preserved).

Amphipnous cuchia Day, 1878, p. 656, pl. 167, fig. 1 (description; synonymy; illustration).

SU 52966: Sta. 7; one; 576 mm.

The following observations and measurements were made on the specimen: head (as measured from the tip of the snout to the posteriormost part of the gill opening) 8.3 in the distance between the tip of snout and anus; maxillary and premaxillary teeth in a single row beneath a fold of skin; palatine teeth in a single row, larger than the maxillary and premaxillary teeth; small scales embedded in the skin. The specimen is of a gray color, darker above with more or less distinct spots in the darker area.

The present specimen is the first to be recorded from Nepal. The species is known from northern India, Assam and Burma.

The following list of Nepal fishes, compiled from various sources, totals 102 species.

CHECK LIST OF NEPAL FISHES

Family CLUPEIDAE
1. *Gudusia chapra* (Hamilton)

Family NOTOPTERIDAE
2. *Notopterus notopterus* (Pallas)

Family CYPRINIDAE
3. *Schizothorax* sp.
4. *Schizothorax* sp.
5. *Oreinus richardsoni* (Gray)
6. *Chela laubuca* (Hamilton)
7. *Chela bacaila* (Hamilton)
8. *Chela gora* (Hamilton)
9. *Chela argentea* Day
10. *Barilius barila* (Hamilton)
11. *Barilius barna* (Hamilton)
12. *Barilius bendelisis* (Buchanan)
13. *Barilius bola* (Hamilton)
14. *Barilius shacra* (Hamilton)
15. *Barilius vagra* (Hamilton)
16. *Barilius tileo* (Hamilton)
17. *Danio aequipinnatus* (M'Clelland)
18. *Danio dangila* (Hamilton)
19. *Danio devario* (Hamilton)
20. *Brachydanio rerio* (Hamilton)
21. *Esomus danrica* (Hamilton)
22. *Rasbora daniconius* (Hamilton)
23. *Aspidoparia jaya* (Hamilton)
24. *Aspidoparia morar* (Hamilton)
25. *Amblypharyngodon mola* (Hamilton)
26. *Barbus chagunio* (Hamilton)
27. *Barbus chola* (Hamilton)
28. *Barbus clavatus* (Hamilton)
29. *Barbus conchonius* (Hamilton)
30. *Barbus sarana* (Hamilton)
31. *Barbus sophore* (Hamilton)
32. *Barbus ticto* (Hamilton)
33. *Barbus hexagonolepis* M'Clelland
34. *Barbus putitora* (Hamilton)
35. *Catla catla* (Hamilton)
36. *Cirrhinus mrigala* (Hamilton)
37. *Cirrhinus reba* (Hamilton)
38. *Crossocheilus latius* (Hamilton)
39. *Garra annandalei* Hora
40. *Garra lamta* (Hamilton)
41. *Garra gotyla* (Gray)
42. *Garra mullya* (Sykes)
43. *Labeo angra* (Hamilton)
44. *Labeo bata* (Hamilton)
45. *Labeo calbasu* (Hamilton)
46. *Labeo dero* (Hamilton)
47. *Labeo dyocheilus* (M'Clelland)
48. *Labeo fimbriatus* (Bloch)
49. *Labeo boga* (Hamilton)
50. *Labeo gonius* (Hamilton)
51. *Labeo rohita* (Hamilton)
52. *Labeo sindensis* (Day)
53. *Rohtee cotio* (Hamilton)
54. *Semiplotus semiplotus* (Hamilton)

Family HOMALOPTERIDAE
55. *Balitora brucei* Gray

Family COBITIDAE
56. *Botia almorae* Way
57. *Botia lohachata* Chaudhuri
58. *Lepidocephalus guntea* (Hamilton)
59. *Nemacheilus beavani* Günther
60. *Nemacheilus botia* (Hamilton)
61. *Nemacheilus corica* (Hamilton)
62. *Nemacheilus rupecula* (M'Clelland)
63. *Nemacheilus savona* (Hamilton)
64. *Nemacheilus scaturigina* (M'Clelland)

Family SILURIDAE
65. *Ompok bimaculatus* (Bloch)

Family BAGRIDAE
66. *Laguvia ribeiroi* Hora
67. *Mystus vittatus* (Bloch)
68. *Mystus bleekeri* (Day)
69. *Rita rita* (Hamilton)

Family SCHILBEIDAE
70. *Ailia coila* (Hamilton)
71. *Clupisoma garua* (Hamilton)
72. *Clupisoma montana* Hora
73. *Eutropiichthys vacha* (Hamilton)
74. *Pseudeutropius atherinoides* (Bloch)
75. *Silonia silondia* (Hamilton)

Family AMBLYCEPIDAE
76. *Amblyceps mangois* (Hamilton)

Family SISORIDAE
77. *Bagarius bagarius* (Hamilton)
78. *Gagata viridescens* (Hamilton)
79. *Gagata nangra* (Hamilton)
80. *Glyptothorax cavia* (Hamilton)
81. *Glyptothorax annandalei* Hora
82. *Glyptothorax horai* Shaw and Shebbeare
83. *Glyptothorax pectinopterus* (M'Clelland)
84. *Glyptothorax telchitta* (Hamilton)
85. *Euchiloglanis hodgarti* (Hora)
86. *Pseudecheneis sulcatus* (M'Clelland)

Family HETEROPNEUSTIDAE
87. *Heteropneustes fossilis* (Bloch)

Family CLARIIDAE
88. *Clarias batrachus* (Linnaeus)

Family BELONIDAE
89. *Xenentodon cancila* (Hamilton)

Family GOBIIDAE
90. *Glossogobius giuris* (Hamilton)

Family MUGILIDAE
91. *Rhinomugil corsula* (Hamilton)

Family CHANNIDAE
92. *Channa orientalis* Bloch and Schneider
93. *Channa punctata* (Bloch)
94. *Channa stewarti* (Playfair)

Family ANABANTIDAE
95. *Colisa fasciata* (Bloch and Schneider)

Family AMBASSIDAE
96. *Chanda nama* Hamilton
97. *Chanda ranga* Hamilton

Family NANDIDAE
98. *Badis badis* (Hamilton)
99. *Nandus nandus* (Hamilton)

Family MASTACEMBELIDAE
100. *Macrognathus aculeatus* (Bloch)
101. *Mastacembelus armatus* (Lacépède)

Family AMPHIPNOIDAE
102. *Amphipnous cuchia* (Hamilton)

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A NEW ZEOMORPH FISH OF THE FAMILY OREOSOMATIDAE FROM THE COAST OF CALIFORNIA, WITH NOTES ON THE FAMILY

By George S. Myers

INTRODUCTION

The fishes of the order Zeomorphi are of world-wide distribution in deeper water on the continental shelves. Except for a few species such as *Zeus faber* (the "John Dory" or "Peterfisch" of Europe) and *Capros aper* (the European Boar-fish) most zeomorphs are little known and seldom seen by ichthyologists, and the classification of most of the families, genera, and species is not in good state. For several years I have been gathering material and data for a review of the Zeomorphi, more recently under a research grant from the National Science Foundation (No. G-4685).

In connection with this work I now have to present the description of a new zeomorph fish from the California coast. At the same time it seems necessary to give some brief notes on the hitherto unrecognized family to which it belongs, and on the included genera.

ZEOMORPH FAMILIES

Usage of familial names for zeomorph fishes has been extremely haphazard. Until Regan (1910) brought them together into a single order, ichthyologists often separated some of the genera in widely different families. At various times the names Zeidae, Cyttidae, Caproidae, and Antigoniidae have all been current. Because few zeomorphs are usually found in any one local marine fauna, and most ichthyologists in the past have worked on areal faunas rather than upon the classification of taxonomic groups on a world-wide basis, few authors have had much comprehension of the familial groupings which they adopted. For example, Gilbert (1905) recognized the families Caproidae (for his new genus *Cyttomimus*), Zeidae (for his *Stethopristes*), and Antigoniidae (for *Antigonia*), despite the fact that *Antigonia* is a caproid and neither of the two other genera appears to be either a caproid or a zeid.

Moreover, the literature on the group is widely scattered and has nowhere been brought together. Even so eminent and able an ichthyologist as Poll has generically misplaced two (*Cyttopsis roseus* and *Zenion hololepis*) of the four zeomorphs treated in his great report on West African marine fishes (1954).

Following Regan's lamentably brief but important paper of 1910, most authors have recognized his grouping of the Zeomorphi into two families, the Caproidae for *Capros* and *Antigonia* and the Zeidae for all the remaining genera. However, American ichthyologists have usually also recognized the family Grammicolepidae. Berg (1940, p. 468) recognizes the latter family but otherwise follows Regan.

Regan is the only modern ichthyologist who has critically compared a wide variety of zeomorph genera with regard to their familial grouping, but he examined the skeletons of only five genera and his remarks, although characteristically succinct and penetrating, omitted mention of many points which must be considered in zeomorph classification. Among these are the extensive modifications of the mouth, widely different allometric growth patterns, profound differences in scale structure (as in the grammico-

lepids), and especially the nature of the young stages.

Although undoubted zeomorph fossils are known from as far back as the Oligocene, and one reputed zeomorph has been described from the Paleocene, the fossil evidence so far uncovered does not tell us a great deal about the history and evolution of the order. However, my preliminary studies indicate strongly that the living forms, which are comparatively few in number, and possibly largely of a relict nature, represent several rather widely divergent evolutionary lines, some of them more distinctive than the majority of generally recognized families of acanthopterygian teleosts. I suspect that most or all of these lines have had a long history, some perhaps since the early Cenozoic. My belief, first expressed in 1937 and recently seconded by Abe (1957), is that the crowding of all the diverse genera of Zeomorphi into two families, some members of which are so unlike as scarcely to be recognized as members of the same order, is neither particularly useful nor expressive of their real divergence.

While I am not yet ready to take up the major problems of zeomorph classification it seems worth while to point out the major groupings of the living genera. The family Zeidae includes *Zeus* and *Zenopsis*, and probably also the three closely related genera *Cyttus*, *Cyttoidops*, and *Rhombocyttus*; the last almost certainly represents a young stage of *Cyttus*. Farther removed, and worthy of subfamilial or familial rank, are the three closely related genera *Cyttopsis*, *Zen*, and *Stethopristes*. A group of uncertain position is formed by the small Pacific fishes of the doubtfully distinct genera *Capromimus* and *Cyttomimus*. *Parazen* forms, alone, a group rather different from all others. The Grammicolepidae (better called Grammicolepididae), with their tiny mouths and extraordinary linear scales, are certainly worthy of familial rank, as are the strange little Zeniontidae (*Zenion* and *Cyttula*) and Macrurocyttidae (*Macrurocyttus*). The Oreosomatidae, with their strange "*Oreosoma*-stage," also deserve familial rank. Finally, there is the family Caproidae, composed of *Capros* and *Antigonia*. This last genus has lately been studies by Fraser-Brunner (1950) and Berry (1959).

THE OREOSOMATIDAE

In 1839, Cuvier and Valenciennes (p. 515, pl. 100) described and figured a most remarkable little oceanic fish obtained by the celebrated expedition of François Peron to Australia (1800-1804), and collected at some unknown place in the Atlantic. They called the fish *Oreosoma atlanticum*.[1] Goode and Bean (1895, p. 227) give a redrawn copy of the side view of the fish, after Cuvier and Valenciennes. The remarkable "hills" with which this fish is covered, and from which the name *Oreosoma* (*oreos*, mountain; *soma*, body) is derived, give it a most peculiar appearance. Vaillant (1893) and Boulenger (1903) have both taken up the relationships of *Oreosoma*, and the latter was sure he had identified *O. atlanticum* with immature South African specimens in the British Museum. However, all of the several genera and species of the Oreosomatidae save *Oreosoma* itself, have been described subsequent to Boulenger's paper, and no one has yet succeeded in linking *O. atlanticum* specifically with one of these forms.[2]

The type of *Oreosoma atlanticum* definitely represents the young of a member of the present family but I have some doubt that Boulenger's specimens, which I have seen and which are small *Allocyttus verrucosus* (Gilchrist), are specifically identical with Cuvier's type. Only close study

[1] Called *Oreosoma coniferum* on the plate.

[2] Waite (1912) recorded and figured an *Oreosoma*-stage fish from New Zealand, which he believed to be identical with *Oreosoma atlanticum*. Whitley (1929) proposed the name *Oreosoma waitei* for Waite's specimen, thus pointlessly imposing on others the work of correctly placing the name.

of the holotype in Paris will settle the matter. It is my intention to take up the identity of the few known *Oreosoma*-stages of this family in a separate paper, after I have seen Cuvier's type. Meanwhile, it may be said that there are two very distinctive kinds of the *Oreosoma*-stage represented in the material I have seen. The one which I provisionally take to represent *Allocyttus* is very different from Cuvier's fish.

While little has yet been recorded of the young stages of any zeomorphs except *Zeus* and *Capros*, my own work indicates that only the Oreosomatidae go through an *Oreosoma*-stage, and this may prove to be one of the most cogent reasons for recognizing the group as a family. However, the peculiar Grammicolepididae may be rather closely allied to the Oreosomatidae, and the spikes or hooks seen on the sides of some grammicolepidids (see especially Barnard, 1940, p. 11 and plate, on *Xenolepidichthys americanus* in South Africa) may be the homologues of the "hills" of *Oreosoma*. These "hills" are, in part, carried over into the adult stage in *Allocyttus verrucosus* as one or two series of small plates on the breast. The one presumed young of a grammicolepidid so far reported is an acanthurid (see Myers, 1937), but the figure of a two-inch *Xenolepidichthys* given by Smith (1949, fig. 274) is remarkably like *Rhombocyttus* in form, and vastly different from *Oreosoma*.

The known Oreosomatidae exhibit a mostly southern distribution, the genera and species being principally from South Africa and southern Australia. There are very few records of them from northern seas. I have examined the holotype of *Neocyttus helgae* (Holt and Byrne, 1908) from off the Irish coast; the only other example of this species so far reported is the type of the nominal *Crassispinis granulosus* Maul (1948) from Madeira.[3] Very recently, Welander, Johnson, and Hajny (1957) have reported an example of *Allocyttus verrucosus* (Gilchrist) from the open North Pacific at approximately 50° N. and 150° W. I have seen the example, which is a late *Oreosoma*-stage, although I am not yet certain of its specific identity. It will be taken up in my paper on *Oreosoma*-stages. It is therefore not too surprising that a distinctive oreosomatid should be found on the California coast, although, so far as I can find, no zeomorph has previously been reported to occur along the Pacific coasts of North, Central, or South America, and no oreosomatid on the Atlantic or Pacific coasts of the Americas or the Pacific coast of Asia.

Xenocyttus nemotoi Abe (1957), known from one example taken from the stomach of an Antarctic whale taken off Wilkes Land, has proved to be impossible to place in my tentative classification of the genera of Oreosomatidae. Its placement must await either more material or a personal examination of the holotype. Abe gives an excellent survey of the literature, and his paper is a useful one. The most important papers on the classification of the genera of oreosomatids are those of Gilchrist (1906), Holt and Byrne (1908), McCulloch (1914), and Barnard (1925).

A subfamily Oreosominae was recognized by Goode and Bean (1895, p. 224, in key) for the sole reception of *Oreosoma*, which was at that time the only genus of the group known. Abe (1957) has also used this term, "only for convenience' sake," as he says, to include the genera here recognized as the family Oreosomatidae.

EXTERNAL CHARACTERS OF THE OREOSOMATIDAE

The following external characters will identify most oreosomatids, but

[3] Laughton (1959, p. 183, fig. 9) has reproduced a photograph taken at a depth of 800 fathoms on a volcanic seamount (not located but probably off western Europe) which clearly shows a large *Neocyttus*. The specimen is almost certainly *N. helgae*. I am indebted to Dr. Stanley H. Weitzman for calling my attention to the figure.

all of the characters do not necessarily hold for young stages: Length of base of soft dorsal fin considerably more than twice length of base of spiny dorsal fin. No bony plates along thoracic or abdominal margins, or along the base of the dorsal and anal fins, at least in adults. Pelvic fins with a spine; pelvics not of unusually large size except in some *Oreosoma*-stages. Pelvic bones (girdle) not greatly widened (as they are in *Zenion*). Body very deep, becoming somewhat more elongate with age. Mouth of moderate size, not greatly upturned, the tip of the lower jaw always at or below the level of the lower margin of the eye except in some *Oreosoma*-stages. Scales very small, rounded, irregularly placed over most of the body, either cycloid or ctenoid, usually rough and strongly adherent on nape, breast, and along dorsal and anal fins. Passing through a postlarval *Oreosoma*-stage in which large, conical protuberances ("hills") or scutes occur on various parts of the body, most notably between the pectoral and pelvic fins and along the dorsal fin base. These "hills" gradually disappear with age, but apparently are in part retained (as a series of small scutes), along each side of the belly, in the adults of certain species. Color of preserved examples usually deep brown; occasionally the sides bear indistinct darker spots. Some species attain a length of nearly four-fifths of a meter. Bottom fishes of the deeper waters of the continental shelf and its slopes, the young often pelagic in the open ocean. Found from the Antarctic to at least 50° N. Very few specimens are known except from off southern Australia and South Africa, where oreosomatids are often taken by commercial trawlers.

The following artificial key will identify the four well-established genera of Oreosomatidae. The generic names *Xenocyttus* and *Oreosoma* cannot yet be placed, as noted above.

A SYNOPSIS OF OREOSOMATID GENERA

1a. First dorsal spine much longer than second; predorsal profile convex, straight, or not greatly concave in known specimens; vomerine teeth absent; eye large but not enormous (not over half length of head); length of thoracic margin greater than that of abdominal margin; anal spine not especially heavy.....PSEUDOCYTTUS Gilchrist.

1b. First dorsal spine much shorter than second; predorsal profile usually somewhat concave, sometimes deeply so; vomerine teeth present or absent.

2a. Thoracic margin (anterior end of pectoral girdle to base of pelvic spine) much longer than abdominal margin (end of pelvic fin base to origin of anal fin); first anal spine very heavy and strong, usually as long as second dorsal spine; predorsal profile deeply concave in all examples yet seen; vomerine teeth present; eye large but not enormous.....NEOCYTTUS Gilchrist.

2b. Thoracic margin about equal in length to abdominal margin; first anal spine not especially large and heavy, usually smaller than first dorsal spine.

3a. Vomerine teeth absent; eye enormous, the horizontal diameter of the orbit equal to two-thirds length of head; predorsal profile deeply concave.....CYTTOSOMA Gilchrist.

3b. Vomerine teeth present; eye large but not enormous, orbit diameter less than half head length; predorsal profile convex, straight, or slightly concave, except perhaps in *Oreosoma*-stage.....ALLOCYTTUS McCullogh.

DESCRIPTION OF A NEW CALIFORNIA OREOSOMATID

Allocyttus folletti, new species
Figure 1

MATERIAL.—Three examples of this fish are known. The holotype (SU 15377) was trawled by a commercial trawler in 230 fathoms on a ridge just north of the submarine canyon of the Eel River in 1949, and was obtained and turned over to Stanford University for identification by F. B. Hagerman of the California Department of Fish and Game. A second, much smaller specimen was obtained on the California coast off Fort Bragg on 18th December, 1953, by Manuel Figueiredo, and is now in the California Academy of Sciences (CAS 25988). A third example, intermediate in size between the other two, was taken off the Mendocino County coast of California between Fort Bragg and Shelter Cove, by Julius B. Phillips of the California Department of Fish and Game and turned over to the ichthyological collection of the University of California at Los Angeles (UCLA W57-13). Thanks are due to Messrs. Hagerman, Figueiredo, and Phillips for seeing that the specimens reached scientific collections, and to Mr. W. I. Follett of the California Academy of Sciences and Dr. Boyd W. Walker of the University of California at Los Angeles for lending the two paratypes.

DESCRIPTION.—*Allocyttus folletti* agrees in most characters with its congener, *A. verrucosus* (see Gilchrist, 1906, for a figure), and *A. verrucosus* var. *propinquus* McCulloch (1914), but differs in many subtle features of its form. The predorsal profile is more concave, the belly is flatter, the snout is less smoothly rounded down, and the nasal boss is more prominent and more rugose. The California species, however, is very similar to *verrucosus* in its scale- and fin-ray counts, but the scales of the two differ considerably. Those of *A. verrucosus* are ctenoid and closely adherent throughout. In *A. folletti*, on the other hand, only the scales of the nape, breast, belly, and of the area along the bases of the dorsal and anal fins, are ctenoid and tenaciously adherent. The scales of the entire mid-side area, lateral line, and caudal peduncle are cycloid and rather deciduous. For example, most of the scales of the caudal peduncle of the holotype have become lost, while the other scales of the mid-side area are rather easily dislodged. The smaller of the two paratypes has lost many of its cycloid scales, except along the lateral line.

The smaller paratype, only 162 mm. in standard length (versus 343 mm. for the holotype), is much deeper bodied than the other two examples, and indicates that allometric growth changes in the body form of *A. folletti* are different from those I have observed in *A. verrucosus*. For one thing, *folletti* at 162 mm. length is much deeper-bodied than any *verrucosus* I have seen. In the small *folletti*, the predorsal profile is somewhat more concave than in the holotype, whereas in smaller *verrucosus* there is scarcely any concavity. However, the small *folletti* exhibits nasal bosses much less prominent and rugose than in the two larger types, but the head does not exhibit the smoothly downcurved head-and-snout profile of smaller *verrucosus*.

Finally, all the specimens of *A. verrucosus* that I have examined (which range in length up to approximately the size of the UCLA paratype of *folletti*) still bear the scutes between the pectoral and pelvic fins which represent the remains of the "hills" of the *Oreosoma*-stage. These scutes of *verrucosus* are illustrated by Gilchrist, McCulloch, Barnard, and Smith. In *A. folletti*, none of the three specimens has any trace of scutes, again indicating that the two species differ considerably in growth pattern.

Fin-ray, scale- and gill-raker counts, and measurements of the three specimens of *A. folletti* are given in Table 1. Inasmuch as the main

Fig. 1. *Allocyttus folletti* Myers. Holotype. Standard length 347 mm. SU 15377. Photo courtesy of California Dept. of Fish and Game.

Table 1. Counts and Measurements of *Allocyttus folletti*.

COUNTS	CAS 25988	UCLA W57-13	Holotype SU 15377
Dorsal fin	V, 33	VII, 30	VII, 32
Anal fin	III, 31	III, 32	III, 31
Caudal fin (principal rays)	i, 6, 5, i	i, 6, 5, i	i, 6, 5, i
Pectoral fins (left and right)	21-21	19-19	21-21
Pelvic fins (left and right)	I, 6-I, 6	I, 6-I, 6	I, 6-I, 7
Gill rakers (left and right, 1st arch)	7/25-6/24	6/20-6/19	6/19-6/19
Pored tubes in lateral line (+ those on caudal fin, left and right)	85+5-90+7	88+4-93+4	95+5-97+3[4]

MEASUREMENTS IN MM.			
Standard length	162	259	347
Standard length minus premaxillary	160	252	341
Greatest body depth (dorsal origin to anal origin)	95	143	185
Head length to end bony opercle	68	99	126
Head length minus premaxillary	66	92	122
Least depth caudal peduncle	10	15	20
Horizontal diameter bony orbit	35	44	59
Width bony interorbital	21	30	39
Snout tip (middle) to anterior rim of orbit	20	28	35
Length maxillary from pre-maxillary symphysis	29	40	55
Length lower jaw to articular angle	38	53	68
Length anal fin base	68	98	139
Length dorsal fin base	78	119	171
Snout tip to origin dorsal fin	94	145	177
Snout tip to origin anal fin	103	163	218
Length first dorsal spine	7.5	6.0	12.0
Length second dorsal spine	19	23	28.5
Length longest soft dorsal rays	22	28	41
Length longest soft anal rays	26	33	46
Length pelvic spine	36	41	45
Length pectoral fin (upper base to end of fin)	31	40	57
Length thoracic edge (to origin pelvic spine)	30	48	60
Length abdominal edge (pelvic base end to anal origin)	30	51	64

[4]Scales on peduncle of holotype lost. Count may err by five scales on either side. However, each of the three fish has more pored scales on right side than on left.

external differences between *folletti* and *verrucosus* are sufficiently evident from the above account, and also because more work remains to be done on the latter fish and its presumed Australian and South African races, I do not at this time present a similar table for *verrucosus*. In addition, there is a so-far unrecorded series of specimens of an *Allocyttus* (close to or specifically identical with *verrucosus*) collected by the U. S. Fisheries Steamer "Albatross" off Tome, Chile, in 1888, now preserved in the U. S. National Museum and at Stanford; the counts and measurements of that series (which was studied many years ago by the late Dr. Charles H. Gilbert and Dr. Carl L. Hubbs) must be included when I take up *A. verrucosus* in more detail.

I take especial pleasure in naming this species for my friend and colleague, Mr. W. I. Follett, Curator of Fishes in the California Academy of Sciences, San Francisco, as a token of personal esteem and as a recognition of his deep interest and broad knowledge of the fish fauna of California.

ON VERNACULAR NAMES FOR OREOSOMATIDS

I have given some thought to the subject of English common names for the family Oreosomatidae and for the present species. All oreosomatids are little known deep-water forms and I have not been able to find that any of them has a really indigenous colloquial name in English or any other language. One or two may have been given manufactured names, but always in connection with the terms "dory" or "boar-fish," derived from the British name "John Dory," current for *Zeus faber*, or "Boar-fish," current for *Capros aper*. However, no fisherman, naturalist, or even layman would ever perceive close resemblance between an oreosomatid and any of the Zeidae, with their immense upturned mouths, highly compressed bodies, and silvery color, or with the boar-fishes, or Caproidae. To apply a common name such as "dory" to a fish of a different family, which bears no close relationship or visual similarity to a dory, is bound to be confusing. While I am not greatly in favor of manufactured names, the present-day trend towards giving all fishes (or at least fish families) some sort of distinctive colloquial name, even if it has to be manufactured, is a strong one, and to forestall the proposal of an unfitting name for the oreosomatids it seems worthwhile to adopt one.

A colloquial name is best when it is short, easily spelt, euphonius, perfectly distinctive and different from all other names, and, especially, widely usable without change in several languages. Such a name is easily derivable from the scientific name *Oreosoma*, a practice which even the American Committee on Common Names of Fishes occasionally accepts (e.g., cichlids, brotulas, molas). I therefore propose to call the oreosomatids "oreos" and *Allocyttus folletti* the "oxeye oreo."

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TWO NEW FISHES COLLECTED BY GENERAL THOMAS D. WHITE IN EASTERN COLOMBIA

By George S. Myers and Stanley H. Weitzman

In recent years General Thomas D. White, Chief of Staff of the United States Air Force, has turned his attention to the fish-fauna of Colombia, and, with Mr. Lee Wulff and Colonel John N. Reynolds, has made collections in the Upper Río Guaviare in 1956, in the Río Magdalena in 1957, and in the Upper Río Caquetà in 1958. Although these angling and fish-collecting trips were all necessarily brief, a large number of interesting fishes were obtained for the Natural History Museum of Stanford University, which provided the collecting gear. Through General White's invitation, the senior author was able to join the 1958 party in Colombia, when a rather extensive collection was made in the vicinity of Tres Esquinas, on the Río Orteguaza close to its junction with the Río Caquetà.

The present paper deals with two hitherto undescribed species of special importance, one because it is an angling fish of growing renown, the other because it is a potential aquarium fish which may soon be imported commercially into the United States.

Family CHARACIDAE

Genus *BRYCON* Müller and Troschel

The fishes of the genus *Brycon* form one of the most characteristic and widespread elements in the Neotropical fresh-water fish fauna. The genus ranges from Guatemala south to the Río de la Plata in the Atlantic drainages, and to Ecuador on the Pacific slope. The species are numerous, and include small ones which appear to be adult at a length of 10 cm. (4

inches) or less and large forms which grow to at least 60 cm. (2 feet) in length. Most of them appear to like swift water. The larger species are well known to the local fishermen everywhere as fine food fishes. General White and Mr. Wulff have caught several species of *Brycon* on light tackle at several localities in the Magdalena, Amazonas, and Orinoco drainages of Colombia, and in Panama. They find them always to be good game fishes. In Colombia, various species are known as sabaleta, sardinata, mueluda, or dorada. In Brazil, the names matrinchão, piracanjuba, piraputanga, and piabanha are used in different localities.

In the westernmost Orinoco drainages of Colombia, two large species of *Brycon* are common. One, *Brycon melanopterus* (Cope) has a humeral spot and a dark streak or smudge (often faint in large examples) along the base of the anal fin. This stripe extends obliquely upward across the caudal base and continues out through the upper lobe of the caudal fin. The other species is characterized by a black stripe along the mid-sides from head through the middle of the caudal fin. It was first obtained by General White, Mr. Wulff, and Colonel Reynolds in February, 1956, at the north end of the Cordillera Macarena, and the circumstances of its discovery have been recorded and illustrated by Mr. Wulff (1958). Since that time, other reports of a black-striped *Brycon* in Venezuela have reached us, and we believe that the new fish is widely distributed in the Orinoco Basin.

Brycon whitei, new species

Figure 1

DIAGNOSIS.—A large species of *Brycon* of the *Megalobrycon* group, with small scales and a short anal fin, related to *B. moorei*, *B. petrosus*, *B. ecuadoriensis*, *B. cephalus*, *B. erythropterus*, and *B. melanopterus*, but differing from all in possessing a broad, black, mid-side stripe from the head through the middle of the caudal base and the caudal fin. Lateral line with 66 + 4 or 5 scales. Anal with iii,22 rays ("23 rays" as counted by Eigenmann's system).

MATERIAL.—Holotype, SU 48818, an adult female, 345 mm. in standard length, collected by General Thomas D. White, Colonel John N. Reynolds, and Mr. Lee Wulff in February 1956, in the vicinity of Los Micos, and the north end of the Cordillera Macarena, at approximately 3°20′ N., 73°56′ W. This locality is the headwaters of the Río Guaviare (Río Orinoco system) just east of the Cordillera Oriental in Colombia. (See World Aeronautical Chart no. 891, 1955 edition.) Paratype, SU 44817, an adult male, 233 mm. in standard length, obtained in the same locality by the same collectors, and at the same time.

DESCRIPTION.—Data for the holotype are given first, those for the paratype are in parentheses. See Table 1 for counts and measurements. Body moderately elongate, compressed, deepest near tips of appressed pectoral fins. Greatest depth of body 3.1 (3.2) and least depth of caudal peduncle 10.0 (11.0) in standard length. Snout blunt; when mouth is closed, the jaws are equal. Head 4.0 (4.2) in standard length; snout 3.1 (3.0) in length of head. Maxillary slender, reaching or somewhat exceeding a vertical with the center of the pupil. Eye (=the diameter of the opening of the "adipose" lid) 6.0 (5.5) in head length. Interorbital region strongly arched in holotype, moderately arched in paratype, bony width 2.1 (2.1). Cranial fontanel well developed in both specimens, separating the parietals and most of the medial borders of the frontals. The frontals in contact only anteriorly, where they meet the ethmoid. Third orbital bone (=great suborbital) slightly separated from the preopercle below. The usual characid number of 8 orbital bones is present.

Fig. 1. *Brycon whitei*. Holotype, SU 48818, adult female, 345 mm. in standard length. (Left side and pectoral fin slightly damaged.)

On each side of the premaxillary there are four different rows of teeth, as follows: The outer row; an oblique inner row more or less parallel with the outer row; a single tooth mesad of the anterior end of the inner row; and a posterior transverse row set behind the single tooth and with its laterad end near the middle of the inner row. The numbers of teeth in these rows (left and right) are as follows (paratype in parentheses): Outer row, left, 10 (12); right, 12 (13). Inner row, left, 8 (8); right, 7 (7). Single-tooth row, left, 1 (1); right, 1 (1). Posterior transverse row, left, 2 (2); right, 2 (2). Each maxillary has two rows of teeth, one tooth in the outer row and the following numbers in the inner row: left, 19 (19); right, 18 (18).

MEASUREMENTS IN MM.	A	B	C
Standard length	345	233	345
Snout tip to dorsal fin origin	176	117	174
Snout tip to anal fin origin	239	167	248
Head length (to end of bony opercle)	85.5	55.5	90
Greatest body depth	113	74	118
Least depth of caudal peduncle	34	22	37
Caudal peduncle (anal base to mid-hypural fan)	45	36	51
Horizontal diameter of eye opening	14.2	10	16.5
Snout length (midpoint of snout tip to eye opening)	28	18.5	31
Width of bony interorbital space	40	24	44
Length of base of anal fin	65	50	79
Dorsal origin to origin of adipose fin	135	86.5	123
Length of pectoral fin	67	44	75
Length of pelvic fin	58	37	61
COUNTS			
Dorsal fin rays	ii,9	ii,9	ii,9
Anal fin rays	iii,22	ii,22	iii,22
Caudal fin rays	10/9	10/9	10/9
Pectoral fin rays (left and right)	i,13-i,13	i,13-i,13	i,12-i,12
Pelvic fin rays (left and right)	i,7-i,7	i,7-i,7	i,7-i,7
Gill rakers, first arch	15+16	15+16	15+17
Scales in lateral line (+ on caudal) (left and right)	66+5-66+4	66+5-66+5	60+4-56+5
Predorsal scales head to dorsal fin	29 irregular	29 irregular	26 irregular
Scales around caudal peduncle	21	21	20
Scales between dorsal origin and lateral line	12	12	11
Scales between pelvics and lateral line	7	7	7
Scale rows on base of anal fin	3	3	4

Table 1. Counts and measurements of A, the holotype (female) of *Brycon whitei* (SU 48818); B, the paratype (male) of *Brycon whitei* (SU 48817); and C, a female of *Brycon melanopterus* (SU 48819) taken at the same locality.

In the lower jaw there are three separate sets of teeth on each side. First there is the outer row. From near the posterior end of the outer row an inner row extends obliquely forward for a distance. Finally, there are the inner conical teeth near the symphysis, one on the left, one on the right. The tooth numbers (paratype in parentheses) are as follows: Outer row, left, 10 (9); right, 9 (9). Inner posterior row, left, 14 (12+?); right, 11+? (13+?). Inner symphysial teeth, left, 1 (1); right, 1 (1).

In color, the two examples (formalin fixed, now in alcohol) are dark dorsally, lighter on the sides, and whitish on the belly. The scale edges are darker and faint longitudinal lines between the scale rows are visible. Along the mid-side, from head to tail, there is a broad black stripe, as wide or wider than the eye diameter anteriorly, narrowing somewhat over the anal fin, and broadening again into a broad black median area on the peduncle and at the base of the caudal. Thereafter, the stripe narrows again and runs out to the ends of the middle caudal rays. There is a fainter dark humeral spot, larger than the eye, just above the origin of the black lateral stripe. Pectoral and adipose fins mostly dark. Top of head and snout dark.

The fins bore a good deal of red in life (see colored photo in Wulff, 1958), and the scales of the sides and back had warm metallic reflections.

REMARKS.—Mr. Lee Wulff, well-known sports fisherman and one of General White's party when *Brycon whitei* was first caught, has described the circumstances of capture and given a fine color-photograph of General White holding the freshly caught holotype (Wulff, 1958). The photo admirably shows the life colors of *B. whitei*. A black-and-white photograph in the same article shows the holotype beside an example of *B. melanopterus* (Cope) of identical size (SU 48819), caught at the same time and place as the holotype. Since Mr. Wulff's article appeared, letters have been received by us from other persons who have caught the black-striped *B. whitei* in other parts of the Orinoco system, indicating a rather general distribution of this game fish. Idrobo (1958, fig. 12) has also figured a freshly caught specimen of *Brycon whitei* from the vicinity of the Cordillera Macarena.

NAME.—We are especially pleased to name this fish for General Thomas D. White, Chief of Staff of the U. S. Air Force, in recognition not only of his capture of the types, but also of his contributions to ichthyology and angling. Through the years he has made many collections of fishes for the Natural History Museum of Stanford University. In addition, he is an ardent aquarist who has collected, brought home, and studied the habits of many of the smaller species in his own aquaria. (See especially Stanford Ichthyological Bulletin, vol. 2, no. 4, p. 90).

RELATIONSHIPS.—Of the species of *Brycon* listed by Eigenmann (1910) and by us (see below), *Brycon whitei* is related only to those large species comprising the poorly defined subgenus *Megalobrycon*. Of these, *B. microlepis* of Paraguay has much smaller scales (lateral line 84) and does not seem to be close. *Brycon whitei* appears to belong to a complex of species including *B. melanopterus*, *B. cephalus*, *B. erythropterus*, *B. ecuadoriensis*, *B. petrosus*, and *B. moorei*. Except for Hildebrand's key (in Eigenmann, 1923, pp. 129-130) to the trans-Andean species, and Böhlke's recent discussion of some Ecuadorean forms (1958), nothing of real importance on the systematics of the species of *Brycon* has been published for nearly a century, and the classification of the genus is in confusion.

Under these conditions, we are unable to say which of the related forms is closest to *Brycon whitei*, which differs in several ways, and notably in color, from all of them. *Brycon whitei* occurs in the same streams with *B. melanopterus*, and the types were caught together with two examples of the latter species. Moreover, we are sure that *B. whitei* does not merely represent one sex of another form, because we have both a male and a female of

it. Finally, we have found no named form which agrees with the counts and proportions and the color of *B. whitei*.

PRINCIPAL TAXONOMIC REFERENCES TO *BRYCON* SUBSEQUENT TO EIGENMANN'S 1910 LIST

For the benefit of other workers we list the species of *Brycon* and some papers on the genus that have appeared since Eigenmann's list of 1910 was prepared. The references given are abbreviated. Complete references for most can be found in the Zoological Record, but some were omitted from that excellent publication, and are so annotated.

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Holobrycon, gen. n. for *B. pesu*. Eigenmann. Ann. Carnegie Mus., vol. 6, p. 33.
Triurobrycon, gen. n. for *B. lundii* Lütken. Eigenmann. Loc. cit.
1912 *B. siebenthali* Eigenmann, n. sp. Guiana. Mem. Carnegie Mus., vol. 5.
B. scapularis Fowler, n. sp. W. Ecuador. Proc. A. N. S. Phila., 1911, p. 502.
1913 *B. henni* Eigenmann, n. sp. Colombia, Indiana Univ. Studies no. 18.
B. argenteus Meek & Hildebrand, n. sp. Panama. Field Mus. Publ. 10, p. 84.
B. petrosus Meek & Hildebrand, n. sp. Panama. Loc. cit.
B. oliogolepis Regan, n. sp. Colombia. Ann. Mag. Nat. Hist. (8), vol. 2, p. 462.
1915 *B. coquenani* Steindachner, n. sp. Venezuela. Denkschr. Akad. Wien, vol 93, p. 37.
1916 Review Panama species. Meek & Hildebrand. Field Mus. Publ. no. 191.
1917 *B. ecuadoriensis* Eigenmann, n. sp. Ecuador. Proc. Amer. Philos. Soc., vol. 56.
B. meeki Eigenmann, n. sp. Ecuador. Loc. cit.
1923 Review N. W. S. American species. Eigenmann. Mem. Carnegie Mus., vol. 9, no. 1.
1930 *B. pellegrini* Holly, n. sp. Amazon. Anz. Akad. Wien, vol. 66, p. 117.
1938 *B. behreae* Hildebrand, n. sp. Panama. Field Mus. Publ. Zool., vol. 22, p. 261.
B. obscurus Hildebrand, n. sp. Panama. Tom. cit., p. 283.
1941 *B. erythrura* Fowler, n. sp. Brazil. Proc. A. N. S. Phila., vol. 93, p. 191. [This is probably not a *Brycon* but a *Salminus*!] [Not in Zool. Rec.]
B. matrinchao Fowler, n. sp. Brazil. Tom. cit., p. 192. [Not in Zool. Rec.]
B. juanensis Rendahl, n. sp. Colombia. Ark. Zoologi, Bd. 33A, no. 4, p. 10. [Not in Zool. Rec.]
1943 *B. coxeyi* Fowler, n. sp. Ecuador. Notulae Naturae, no. 119.
Othonophanes bolivarensis Dahl, n. sp. Colombia. K. fysiogr. Sällskr. Lund Förh., vol. 12, p. 215.
1944 *B. juradoensis* Fowler, n. sp. Colombia. Proc. A. N. S. Phila., vol. 96, p. 232.
1945 *B. posadae* Fowler, n. sp. Colombia. Proc. A. N. S. Phila., vol. 97, p. 103.
1949 *B. orbignyanus*, notes. Gil, Revista Mus. La Plata, vol. 5, p. 351.
1950 *B. travassosi* Amaral-Campos, n. sp. Brazil. Pap. Avul. Dep. Zool. S. Paulo, no. 9.
1955 *B. moorei sinuensis* Dahl, n. subsp. Colombia. Soc. Linn. Sincelejo (Colombia), 1955. [Not in Zool. Rec.]
B. fowleri Dahl, n. sp. Colombia. Tom. cit. [Not in Zool. Rec.]
1958 Notes on Ecuadorean species. Böhlke, Proc. A. N. S. Phila., vol. 110, p. 60.
B. acutus Böhlke, n. sp. Ecuador. Tom. cit., p. 67.

Family CALLICHTHYIDAE

Genus *CORYDORAS* Lacepede

These small armored catfishes comprise the largest genus of the family,

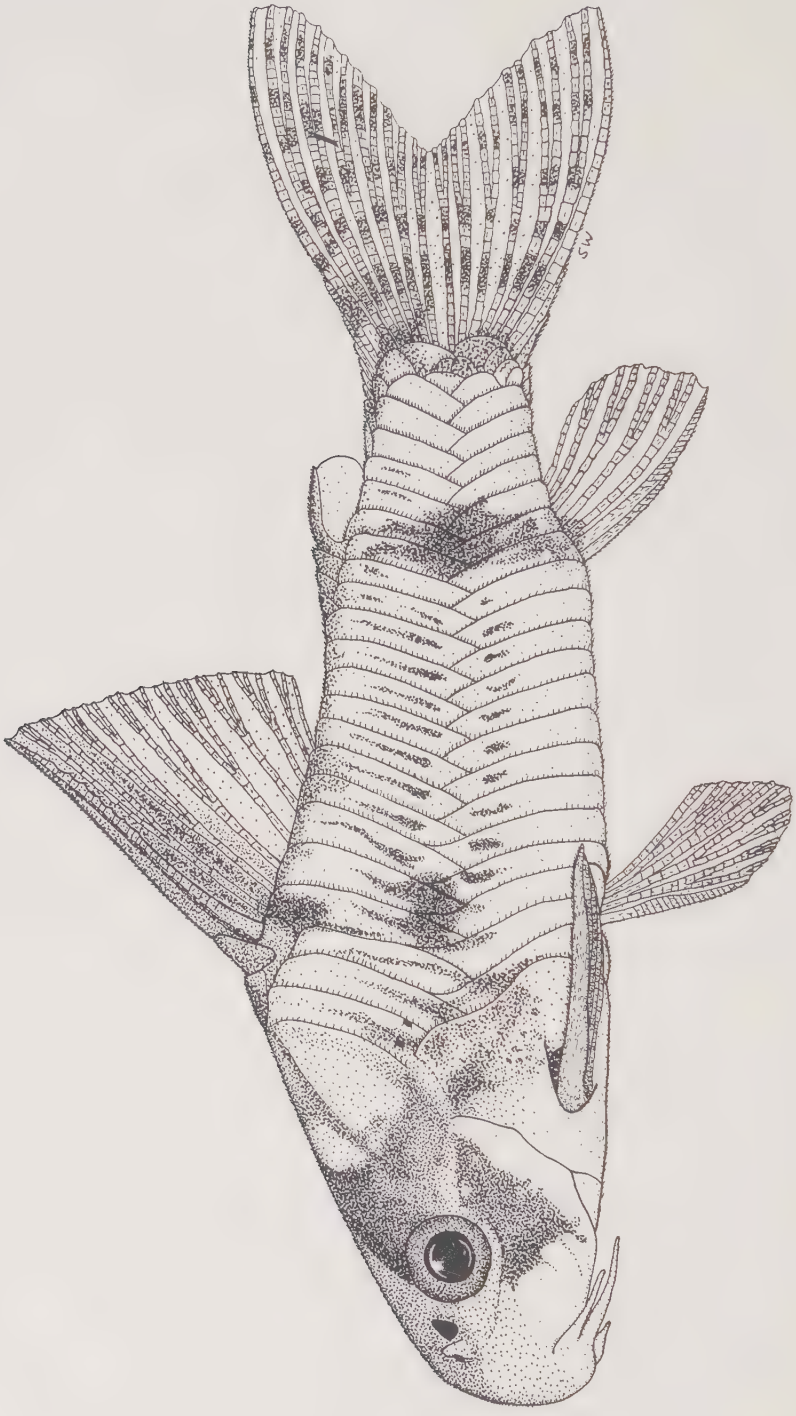

Fig. 2. *Corydoras reynoldsi*. Holotype, SU 50702, 27.1 mm. in standard length.

as well as one of the most difficult problems in South American fluviatile ichthyology. While there are several fairly well-defined morphological groups within the genus, many species are rather similar morphologically, and differ most strikingly in the color pattern. For this reason, one might speculate that there must be series of allopatric subspecies which grade into one another either at subspecific geographical borders or in a clinal way. The facts that many of the species are known from only one or a few widely separated localities, and most of the material now available comes from tropical aquarium fish importers and has no good locality data, easily permit speculations of the kind mentioned. It may be, and probably is, quite true that in certain cases there are clinal variations in species of *Corydoras*. However, the facts available so far are not sufficient to demonstrate such variation in a valid manner.

The senior author has collected a number of species of *Corydoras* in southeastern Brazil and in Colombia. At any one locality, the local forms of *Corydoras* seem to have a very restricted distribution, one species being taken in one caño or on one sandbank, and quite another species being found in a similar situation nearby. In rare instances, two species may be taken in the same habitat at the same place, but unless collecting is done intensively by an experienced collector, one seldom finds all the forms of *Corydoras* that really exist at or near one's collecting headquarters.

These facts indicate clearly that any real understanding of the systematics and geography of *Corydoras* is quite impossible on the basis of materials now available. It will have to await the accumulation of a large number of collections accompanied by exact locality and ecological data, for the senior author's field experience indicates that systematic studies of closely allied forms of *Corydoras* without such data are on very shaky ground.

The junior author has been interested in the systematics of *Corydoras* for a long time, and has already done rather extensive work on the genus. He agrees wholly with the senior author's views expressed in the above paragraph, and has set out on what both of us feel to be the only sound way to attack the problem. This is the description and accurate figuring of available forms with good locality data, of types, and of specimens (with locality data if possible) which without reasonable doubt appear to represent named forms of which types are not available. In this way it is hoped to build up, slowly, a reliable body of data on *Corydoras* which may eventually be of sufficient magnitude to permit some firm conclusions. The accompanying description forms one part of this program. Two other similar contributions by the junior author are also published in this issue of the Bulletin; for citations to his previous contributions, see those papers.

Corydoras reynoldsi, new species

Figures 2, 3.

DIAGNOSIS.—A *Corydoras* possibly more or less distantly related to *C. melanistius* Regan and its relatives, but abundantly distinct in its color pattern not only from *C. melanistius* but from any *Corydoras* yet described. The most striking part of the body pattern consists of two dark, vertically elongate blotches or bars, the anterior bar mostly on the fifth and sixth superior scutes and the posterior below the adipose fin. Base of dorsal spine, basal part of the first two soft dorsal rays, their membranes, and the azygous predorsal scute all involved in a blackish blotch, the rest of the fin being clear. Caudal with four or five irregular cross-bars on the rays but not the membranes.

MATERIAL.—Holotype, SU 52349, an adult, 27.1 mm. in standard length,

collected by General Thomas D. White, Colonel John N. Reynolds, Lee Wulff, and George S. Myers on February 13, 1958, at Tres Esquinas Station no. 12. This locality may be briefly cited as: A small stream tributary to the Río Orteguaza opposite the town and air base known as Tres Esquinas, Caquetà Province, Colombia. Tres Esquinas, which is shown on maps as on the right bank of the Río Caqueta, opposite the mouth of the Río Orteguaza, is now located a short distance up the Río Orteguaza on its right (western) bank. The stream mentioned empties into the river directly across from the town. It is really a small caño, or side channel, and breaks away from the river above Tres Esquinas, re-entering opposite the town. The caño has a sandy bottom, narrow sandy riffles, and deep holes up to five feet deep and 50 feet wide. Our visit was at the time of low water and the current was not great. The stream is partly shaded by forest, partly open to the sun. The *Corydoras* was taken in sandy shallows with little current. The fish fauna is large. The largest and most abundant cichlid present was *Petenia myersi* Schultz, the commonest gymnotid was the small, translucent *Gymnorhamphichthys hypostomus* Ellis, and the dominant small characid was *Ctenobrycon hauxwellianus* (Cope). Loricariids and pimelodids of several genera were common. Small *Serrasalmus* were common but almost impossible to catch. According to World Aeronautical Chart no. 891 (1955 edition), the locality is at approximately 0°45'N., 75°15'W.

Paratypes, SU 50702, seven specimens, 22.3 to 31.5 mm. in standard length, taken with the holotype.

DESCRIPTION.—(Holotype first; data on paratypes in parentheses; all proportions in standard length unless otherwise indicated. For measurements see Table 2). Body fairly elongate, greatest depth 2.9 (2.8-3.0). Least depth of caudal peduncle 6.6 (6.2-7.0). Dorsal fin origin nearer to snout tip than to caudal base. Distance between snout tip and anus 1.9 (1.8-1.9). Origin of anal fin to snout tip 1.2 (1.2-1.2). Lateral scutes 23/30 in all specimens. Abdomen naked. Azygous middorsal scutes 3 (2-4) before adipose fin and 1 before dorsal fin in all specimens. Pectoral fin base incompletely surrounded by coracoid. Naked area between coracoids 8.7 (8.0-9.5 in specimens appearing to be males, 7.0-7.9 in specimens appearing to be females).

Head length 3.3 (3.3-3.6); its greatest width 1.2 (1.1-1.2) in its length. Least width of bony interorbital 2.0 (2.1-2.3) in head length. Dorsal profile of snout continuously and strongly convex. Inferior rictal barbel reaching to a point almost directly below posterior margin of pupil. Greatest diameter of bony orbit 1.4 (1.1-1.6) in snout, 3.3 (2.6-3.3) in head length. Greatest width of suborbital 1.9 (1.5-3.0) in orbit.

Dorsal fin I,7 in all specimens, the last fin ray split to its base. In all specimens appressed dorsal fin spine and first soft ray not reaching adipose fin spine, which is 1.1 (0.8-1.1) in orbit. In holotype and paratypes anal fin ii,5, last ray not split to its base. Pectoral fin I,8 (I,7-I,8). In all specimens the pelvic fin has rays i,5. Caudal fin with principal rays 7/7. The pectoral spinules vary from 16 to 38, there being fewest in the smallest specimens, most in the largest. All specimens have small, posterolaterally directed spinules.

COLOR OF HOLOTYPE IN ALCOHOL.—Ground color pale yellow-tan. Two dark mid-side blotches, the first mostly on the inferior portion of the fifth and sixth superior body scutes. The second or posterior blotch lies below the adipose fin and covers almost three scute rows. In some of the paratypes the blotch is more of a vertical bar, two to three scutes wide, extending from the anterior base of the anal fin to the anterior base of the adipose fin. A paler blotch occurs on the inferior posteriormost scutes at the base of the caudal fin. A series of distinct dark spots on the upper fourth of the 4th to the 13th inferior body scutes. Almost no markings on the 17th to the 20th inferior scutes. A very dark spot on the upper third

of the superior fifth body scute. This spot is continuous with the dark anterior portion of the dorsal fin. The first 15 superior body scutes each have a thin dark vertical stripe. The 16th and the 19th to 20th have this stripe only on their upper halves. On the 5th to 6th and 17th to 18th, the vertical dark stripes are continuous with the black blotches. The azygous scute before the dorsal fin is dark, as is the anterior base of the dorsal fin, its spine, and the first two rays and adjoining membrane. The rest of the dorsal fin is hyaline. There is a very dark stripe along the midlateral portion of the dorsal fin spine, and the membrane between the first and second rays is especially dark. The upper borders of the 5th to 19th superior scutes are dark as are the azygous scutes anterior to the adipose fin and the adipose fin spine. The adipose fin is hyaline except for its spine. The caudal fin has about four or five narrow, irregular, vertical dark bars. The anal fin is hyaline except for a small dark spot at the base of the second, third and fourth rays. The pelvic fin is hyaline. The coracoids are pale ventrally, with dark markings superiorly. The top of the head is dark brown to black, the fontanel being brown. The dark markings on the head and below the eye shown in the figure of the holotype are typical also of the paratypes.

REMARKS.—As with many other species of *Corydoras*, the relationships of

Measurements	Holotype	Paratypes						
Standard length	27.1	31.5	29.2	28.9	24.5	22.3	25.0	24.4
Head length	8.2	9.0	8.3	8.2	7.3	6.7	7.2	7.3
Snout length	3.6	4.2	3.6	4.1	3.4	2.7	3.1	3.0
Least width of bony interorbital	3.7	4.1	3.9	3.6	3.1	2.8	3.2	3.2
Greatest diameter of bony orbit	2.5	2.7	2.6	2.8	2.5	2.4	2.5	2.8
Greatest width of suborbital	1.3	1.4	1.7	1.2	0.8	0.8	1.0	1.1
Length of fontanel	2.7	2.4	2.9	2.8	2.4	2.1	2.5	2.1
Length of predorsal scale	1.5	1.9	1.7	1.8	1.1	1.2	1.3	1.3
Greatest width of head	6.6	7.8	6.9	7.4	6.2	5.6	6.3	6.0
Snout tip to dorsal fin origin	13.7	14.7	14.1	14.4	11.8	10.5	10.8	10.9
Snout tip to adiposé fin origin	22.8	26.5	24.4	24.2	20.0	18.6	20.8	20.6
Snout tip to anal fin origin	22.2	25.5	23.3	23.3	20.5	18.5	20.2	20.2
Snout tip to anterior edge of anus	14.6	16.7	15.5	15.8	13.3	11.8	13.2	12.9
Greatest body depth	9.5	10.6	10.0	10.3	8.0	7.4	8.4	8.3
Least depth of caudal peduncle	4.1	4.5	4.4	4.4	3.8	3.6	3.9	3.9
Distance between coracoids	3.1	3.3	4.2	3.7	3.1	2.6	3.2	2.6
Length of dorsal spine	9.2	10.2	8.2	8.9	7.1	6.1	8.6	7.0
Length of pectoral spine	8.9	10.5	8.7	10.2	6.6	7.6	8.8	7.5
Length of adipose spine	2.2	3.3	3.4	3.2	2.5	2.5	3.0	2.5

Table 2. Measurements in millimeters of specimens of *Corydoras reynoldsi*.

this new species to others are not clear. *Corydoras reynoldsi* keys to near *C. melanistius* Regan in Gosline (1940). Yet it does not appear to be especially closely related to *C. melanistius* nor to any member of Gosline's group of species having a barred caudal fin. *Corydoras reynoldsi* differs from *C. melanistius* in having a more convex snout in profile and a more slender body. The morphology of the pectoral spines is quite similar (Fig. 2, 3). There are some similarities in the color pattern, since both have a black spot at the base of the dorsal fin, although its extent is greater in *C. melanistius* (a number of other species of *Corydoras* have a similar spot). In both species the anterior rays and adjoining membrane of the dorsal fin are dark, and the caudal fin is barred. A similarly shaped dark area occurs below the eye in each species. However, here the similarity in color pattern ends. *Corydoras melanistius* has about 10 irregular bars on the caudal fin, *C. reynoldsi* has about 5; *C. melanistius* has no large spot below the adipose fin, no dark pigment at the base of the anal fin, and no dark medial blotch below the anterior part of the dorsal fin. *Corydoras melanistius* has small dark flecks or spots distributed over most of the upper two thirds of its body; these are lacking in *C. reynoldsi*. There appears to be no other known species of *Corydoras* with a color pattern and a body shape like this new species.

Fig. 3. *Corydoras reynoldsi*. Pectoral fin spine, ventral view, left spine.

Perhaps it should be noted that *Corydoras caquetae* (Fowler) 1943, also described from the Río Orteguaza, is not at all like *C. reynoldsi*. *Corydoras caquetae* is reported to be deeper bodied (2.4 in standard length) than *C. reynoldsi* (2.8-3.0), and to have "irregular and variable brown spots [on the body], more or less as 4 longitudinal rows, with 2 on each series of body plates." The caudal fin of *C. caquetae* has "3 dark brown transverse bands, outermost little evident." The type of *Corydoras caquetae* should be compared with that of *C. melanistius*. The color pattern and body shape of the two species appear somewhat similar.

We take great pleasure in naming this new species of *Corydoras* for Colonel John N. Reynolds of the U. S. Air Force, an ardent aquarist and a fine fish collector, who took part in the capture of the type specimens.

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PYRRHULINA SPILOTA, A NEW SPECIES OF CHARACID FISH FROM SOUTH AMERICA

By Stanley H. Weitzman

Department of Anatomy, Stanford University School of Medicine

The characid fish here described was imported alive from South America by Paramount Aquarium Inc., for distribution in the aquarium trade. Mr. Fred Cochu of Paramount Aquarium Inc. left several live specimens at the Mei Lan Aquarium, Oakland, California, requesting Mr. Bill Jue to pass some of them on to Dr. George S. Myers for identification. Since I am in the process of revising the species of *Pyrrhulina*, *Copella* and *Copeina*, Dr. Myers loaned the specimens to me. I wish to thank all these persons for making it possible for me to describe this fish.

Pyrrhulina spilota, new species

Figure 1.

MATERIAL.—Holotype, a male, SU 52352, standard length 53.0 mm. Paratype, a female, SU 52353, standard length 45.0 mm.

DESCRIPTION (Holotype first; data from paratype in parentheses; all proportions in standard length unless otherwise indicated).—Dorsal fin rays ii,8 (ii,7); anal fin rays iii,9 (iii,9); pelvic fin rays i,7 (i,7); principal caudal fin ray count 10/9 (10/9); pectoral fin rays i,13 (i,12). Scales in a lateral series to caudal base 26 (25); total scales in lateral series including scales on caudal fin 29 (30); scale rows between dorsal fin and anal fin 5 (5); scales around caudal peduncle 10 (10); median predorsal scales 12 (11). Standard length 53.0 (45.0); head length 14.1 (12.2); snout length 4.2 (3.4); least width of bony interorbital 5.4 (4.8); eye diameter 3.8 (3.6); snout tip to dorsal fin origin 30.2 (25.3); snout

Fig. 1. *Pyrrhulina spilota*, new species. Upper specimen is the holotype, SU 52352, male, 53.0 mm. standard length; lower specimen is the paratype, SU 52353, a female, 45.0 mm. standard length.

tip to anal fin origin 38.5 (32.7); greatest body depth 13.3 (11.8); least depth of caudal peduncle 7.4 (5.9); length of caudal peduncle 10.1 (9.8); length of longest dorsal fin ray 11.0 (8.6); length of longest anal fin ray 11.4 (7.3); length of upper caudal fin lobe 15.9 (13.3); length of the lower caudal fin lobe 13.0 (10.8). Dorsal fin origin from tip of snout 1.8 (1.8). Anal fin origin behind origin of posteriormost dorsal fin ray. Anal fin origin from tip of snout 1.4 (1.4). Anal fin margin strongly convex. Length of longest dorsal fin ray 1.3 (1.4); of longest anal fin ray 1.2 (1.7) in the head length. Length of the lower caudal fin lobe measured from the caudal fin base to the farthermost tip of the lower caudal fin lobe 1.2 (1.2) in the same measurement of upper caudal fin lobe. Head 3.8 (3.7). Depth 4.0 (3.7). Eye 3.7 (3.4) and least depth of caudal peduncle 1.9 (2.1) in head length. Interorbital 2.6 (2.5) and snout 3.4 (3.6) in head.

All the teeth in the jaws are simple and slightly recurved cones. There are 27 left, 25 right (? [damaged] left, 25 right) teeth in the outer row on the premaxillary. The inner tooth row on this bone has 40 left, 44 right (35 left, 39 right) teeth. The maxillary has 13 left, 12 right (11 left, 12 right). The dentary has 20 left, 21 right (20 left, 17 right) teeth in the outer row and 45 left, 51 right (50 left, 45 right) in the inner row. These counts are probably only approximate, as the teeth in this species are extremely small and even when the jaws are magnified 90 times they are difficult to count. Alizarin preparations would make accurate tooth counts possible; unfortunately sufficient specimens were not available to make such preparations.

COLOR IN ALCOHOL.—Holotype: General body color dull light brownish gray with a yellowish, dusky white belly. The scales of the first two rows on the back are a dark brownish gray, those in the first row without a central pale area, those in the second with a slightly paler central area. Third, fourth and fifth scale rows all have a fairly evident central pale area under each scale. Above and also slightly anterior to the anal fin origin there is an irregular, dark gray spot that more or less follows the scale borders of the fourth and fifth scale rows in this region. The scale borders above the upper half of the fourth scale row are a pale brownish gray along the entire length of the body. The body color below the superior border of the sixth scale row is pale yellow, overlaid with a dusky color. There is a distinct, fairly dark gray spot on the postero-inferior portion of the caudal peduncle just anterior to the origin of the rays of the lower caudal fin lobe.

The ventral half of the head is pale silvery, especially that part anterior to the opercle. A pale gray band extends from the upper part of the lower jaw to the iris of the eye and continues beyond the iris across the opercular bone to its posterior border; the opercular flap is without dark pigment. The first scale of the fourth and the upper one half of the first scale of the fifth row is black. The top of the head above the dark, snout-opercle stripe is a dark tannish gray.

The dorsal fin is without a dark spot; however, it is somewhat more dusky on its proximal one half. The two caudal fin lobes are likewise without dark pigment except that associated with the proximal one half of the scales covering the lobes' bases; here they are somewhat dusky. The pectoral fin is hyaline. The pelvic fin is also hyaline except for a narrow distal border not exceeding about one millimeter in width. The anal fin is well marked; the proximal one third of the third to ninth rays is dusky to black; the distal tips of the fourth to ninth rays are black in an irregular border up to two millimeters wide; the distal third of the 10th and 11th rays are black, their distal tips hyaline.

COLOR IN LIFE.—The general body color was a light tan and the gray pigment associated with the fourth, fifth and sixth scale rows did not show

except in the region of the spots. At times the dark spots along the fifth scale row (and on the fourth scale row at the location of the anteriormost spot) became black. This was also true of the spot on the caudal peduncle. This has given rise to the common name of four-spot Pyrrhulina. The upper half of the iris was orange, the lower half a dusky silver. The dark stripe extending from the lower jaw to the gill cover was intense black and the distal third of the dorsal fin rays was a pale milky orange color.

A faint dusky spot occurred on the proximal, anterior third of the dorsal fin and extended along the base of the fin from the third to the last dorsal fin ray. The caudal fin and lower part of the caudal peduncle was pale orange. The portion of the anal fin not colored with black was orange except for the first and second rays which were white. The distal tips of the upper first five and especially the lower first six procurrent and principal caudal fin rays were white in life. This gave the effect of a superior and inferior white border on the caudal fin. The paratype (a female) was colored much like the holotype (a male) but the fin rays were not tipped with as much black and in life the orange pigment was much paler. The female did not have black-tipped rays in the pelvic fin.

RELATIONSHIPS.—*Pyrrhulina spilota* appears to be most closely related to *lugubris* Eigenmann (1922) and to *P. brevis* Steindachner (1875). Certainly the color pattern of *spilota* most closely resembles that of *lugubris lugubris* and its close color variant or subspecies *Pyrrhulina lugubris obermülleri* Myers (1926). I tentatively consider *obermülleri* as a subspecies of *lugubris*. The males of *lugubris lugubris*, *lugubris obermülleri* and *brevis* all have a very narrow black edging on the anal and pelvic fins. The male of *spilota* has a broader edging on the anal fin than any of these. Males of *australis* Eigenmann and Kennedy (1903) have a narrow black distal border on the pelvic fins only. *P. brevis* has a black spot on the dorsal fin; its distal rays are tipped black. Also, *brevis* has the black midside stripe continued onto the lower part of the caudal peduncle. Both *brevis* and *australis* have 20 to 23 scales in a longitudinal series while *spilota* has 25 to 26. The holotype and paratypes of *lugubris obermülleri* have 19 to 21 scales in a longitudinal series and two paratypes of *lugubris lugubris* have 20 and 21 scales in a longitudinal series. In addition, both forms of *lugubris* have the distal rays of the dorsal fin quite black and the distal one half of the dorsal fin quite dusky. The distal tips of all the caudal fin rays are black in *obermülleri*. There is some indication of black or dusky spots toward the basal third of the anal fin of *obermülleri*. Both forms of *lugubris* have dark brown pigment extending from the posterior border of the operculum to the lower part of the posterior end of the caudal peduncle. Both forms have a darkening of this pigment above the pectoral fin but neither show any evidence of having the four-spot pattern of *spilota*.

Specimens of *Pyrrhulina lugubris lugubris* and *lugubris obermülleri* have the following tooth counts, 9 to 11 maxillary teeth, 15 to 16 outer and 26 to 30 inner premaxillary teeth. In the lower jaw they have 14 teeth in the outer row and 29 to 32 teeth in the inner row. This is quite different from the counts given above for *spilota*.

Pyrrhulina vittata Regan (1912) is quite different from *spilota* although it is somewhat similarly spotted. Apparently *vittata* does not reach much over 30 mm. in standard length and therefore is much smaller than *spilota*. An adult male (SU 19420) of *vittata* measures 30.4 mm. in standard length. The type was recorded by Regan as having a length of 28 mm. and as far as I have been able to determine specimens of much greater length than these are not recorded in the aquarium literature. *Pyrrhulina vittata* differs from *spilota* in the following additional characters. It has only 22 scales in a longitudinal series (*spilota* has 25 to 26). *P. vittata* has much more

extensive body spots, especially the spot above the anal fin. This spot extends dorsally to the lower portion of the first scale row and ventrally to the anal fin. The entire anal fin is dusky in *vittata*. In addition, the specimen of *vittata* examined by me has three rows of teeth on the lower jaw, the second row having about 34 to 36 teeth (45 to 51 in *spilota*). The outer row has 15 (17 to 21 in *spilota*). The innermost row of teeth of this specimen may be the so-called replacement teeth that commonly occur in most characids; however, it is as well developed as the middle row and the teeth appear to be functional. In other species of *Pyrrhulina*, *Copella* and *Copeina* examined, the "replacement" teeth could not be detected except in specimens stained by alizarin. The replacement teeth of alizarin preparations appear to be nonfunctional for they are buried in flesh. The "replacement" teeth are not prominent in *spilota*.

In summary *Pyrrhulina spilota* appears related to *brevis*, *australis* and *lugubris*. It differs from all of these in color pattern, an elongate, more slender form, more scales in a lateral series and a greater number of teeth in the jaws.

The name *spilota* is from the Greek *spilotus*, meaning spotted.

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THE SYSTEMATIC POSITION OF PITON'S PRESUMED CHARACID FISHES FROM THE EOCENE OF CENTRAL FRANCE

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INTRODUCTION

The large and varied family of fresh-water teleostean fishes known as Characidae forms the most generalized of the living groups of the order Ostariophysi. The order is one of the largest among teleostean fishes, and, except for a few families of catfishes, is strictly confined to fresh water. The family Characidae inhabits tropical America and Africa, and probably has done so for a long time (Myers, 1938). Confinement of the characids to these southern continents, and their absence in the northern ones, is the most important of the evidence adduced by Eigenmann (1909) and Regan (1922) for the existence of a Mesozoic or early Cenozoic continental connection between Africa and South America - a subject that again is receiving attention (Mayr, 1952; Darlington, 1957). Fossil evidence of the presence of the Characidae in the northern continents would be of the utmost importance in explaining the present disjunct distribution of the members of this family. Piton's report in 1938 of two genera and two species of Characidae from the Lutetian of Puy-de-Dôme, France, apparently proved that this family existed in Europe in the early Cenozoic. In the present paper I have attempted to evaluate Piton's data and conclusions, and to make a more secure identification of the family to which his presumed characids belong.

THE CHARACIDAE

Before proceeding to a consideration of the French fossils, it seems desirable to provide some background material on the Characidae and the fossils so far referred to the family.

The order Ostariophysi is characterized by the modification of the anterior vertebrae into a *pars sustentaculum* and its associated ossicles which are together known as the Weberian apparatus (Sagemehl, 1885; Bridge and Haddon, 1893; Chranilov, 1929; Watson, 1939; Nelson, 1949; Weitzman, 1954; and others). The Weberian apparatus distinguishes these fishes from all other orders of primitive teleosts.

As noted above, the Characidae are structurally the most generalized of the Ostariophysi. Regan (1911) divided the Characidae into several families, but my own work (Weitzman, 1960a; 1960b) indicates that, for the present, Regan's families should not be recognized.

Darlington (1957) discussed the problem of how the disjunct distribution of the characids came about, and concluded that the Characidae reached South America sometime during the Cretaceous, either from Africa by a land bridge, or from tropical Asia across the Bering Land Bridge by way of North America. He also postulated that characids once existed in tropical Asia, and that there well may have been a characid fauna common to Asia and Africa. Darlington favored the hypothesis that characids reached South America from Asia by way of North America, and later became extinct in North America and Asia. Since no fossil characids are known from Asia, and the North American records of fossil characids are very dubious, this hypothesis suffers from lack of evidence. However, the fossil fishes of Asia are little known, and it is quite possible that fossil characids may

be found there. Piton's record of Eocene fossil characids from France has given support to the idea that characids have existed in Holarctica. As will be shown below, I do not believe that Piton's fossil fishes are characids, or even members of the order Ostariophysi. Thus the slim leg of support for Holarctic occurrence of characids is removed. The hypotheses of continental drift and of a Mesozoic connection between Africa and South America are not dead - even among geophysicists (Runcorn, 1959) using geophysical evidence. I believe, therefore, that the concept of characids crossing a filter land bridge between Africa and South America should receive at least as serious consideration as the concept of their migration across Asia and North America to reach South America.

Fossil characids are few in number, and so far have helped little to solve the problems of characid distribution. The best known are those from an apparently Late Tertiary lignite at Tremembé, near Taubaté, in the state of São Paulo, Brazil. Fishes from this deposit were first described by Woodward (1898), and discussed later by Eigenmann and Myers (1929), and by Schaeffer (1947), who reduced the known forms to a single genus. Recently, Travassos and da Silva Santos (1955), with more knowledge of characids and abundant material, have shown that four Recent genera are represented by fossil species at Tremembe. These are unquestionably characid fossils.

Cockerell (1921) described fish scales from a Miocene deposit in Peru which he referred to a new genus (*Characilepis*) of the Characidae, and other scales (*Erythrinolepis*) from North American Cretaceous marine deposits on which he based a new but presumably related family (Cockerell, 1919). There is no real evidence that the scales of *Erythrinolepis* are those of characids or characid-like fishes. Hay (1929, p. 719) referred the Upper Cretaceous fish genus *Ischyrtza* Leidy, from the eastern and southeastern United States, to the Characidae, but no recent work has confirmed his transfer of this genus from the Esocidae, where it was formerly placed (Hay, 1902, p. 398). Leidy's specimens were teeth, and the evidence used to place them in the Characidae is of doubtful value. Other than the referral of fragments from Tertiary deposits in Peru to the Recent genus *Myletes* (Peyer, 1929), of African material to the Recent genus *Alestes* (mentioned by Romer, 1945, p. 583), and of African Pleistocene fish teeth to the genus *Hydrocyon*[1] by Greenwood (1959), this completes the records of real and presumed fossil Characidae.

THE FOSSIL FISHES OF THE MENAT SCHISTS

A schist said to be of Lutetian age, at Menat, Puy-de-Dôme, in central France, has produced several fresh-water fishes. However, the most arresting of the discoveries in this lake deposit was announced by Piton in 1938, when he described from it two new genera and two new species of presumed Characidae, *Prohydrocyon pellegrini* and *Procharacinus arverniensis*.

The schist of Menat (dated as Lutetian) is roughly equivalent in age to the Bridger (Middle Eocene) of North America (Wood and others, 1941). In addition to the two supposed Characidae mentioned above, fishes from Menat have been identified by Piton as *Amia valenciennesi* (Agassiz), family Amiidae; *Chela arambourgi* Piton and *Chela brongniarti* (Agassiz), family Cyprinidae; and *Percilia angusta* (Agassiz), family Serranidae (Piton assigns this to the family Percidae). The identification of an Eocene percomorph from France with a Recent genus (*Percilia*) of fresh-water Serranidae

[1] Myers (1950) has shown that *Hydrocynus* Cuvier 1817 must replace *Hydrocyon* Cuvier 1819. Usage of *Hydrocionichthys* Travassos for *Hydrocynus* has been discussed by Myers and Weitzman (1960).

known only from Chile (see Eigenmann, 1909, p. 290) should be looked upon with suspicion. Moreover, reference of the supposed cyprinids to the tropical, south-Asian, Recent genus *Chela* should be reinvestigated, especially in the light of the work on this genus and its relatives by Silas (1958).

Professor George S. Myers of Stanford became interested in the presumed fossil characids several years ago, and obtained additional information about them through Miss Marie-Hélène Sachet, of Washington, D. C. Miss Sachet's father, the late Dr. Sachet, was in charge of the collections of the Société Scientifique du Bourbonnais et du Centre de France, Moulins, in which Piton's types were deposited. Through his kindness, and that of Miss Sachet, photographs of the type of *Prohydrocyon pellegrini* were obtained by Prof. Myers. Doctor Sachet informed him that the type and only known example of *Procharacinus arverniensis* was carried away by an officer of the German occupation forces during World War II. Professor Myers has asked me to express his indebtedness to the late Dr. Sachet and to Miss Sachet for their great kindness and aid.

In connection with my osteological work on the Characidae, Prof. Myers has recently turned over to me the information on the type specimens given above and the photographs of *Prohydrocyon pellegrini*. I am greatly indebted to him for this and for his helpful suggestions concerning the present paper.

DISCUSSION OF THE SUPPOSED CHARACINS OF MENAT

In examining the photographs of *Prohydrocyon pellegrini* (Figs. 1 and 2), as well as Piton's original paper (1938), I found good reason to doubt that these fishes are truly characids. A search for characid osteological characters in the descriptions and in the photographs failed to reveal any data to confirm Piton's contention that these are fossil characids.

Piton's descriptions do not include any structural comparisons with characids. With reference to *Prohydrocyon pellegrini*, he said: "Les charactères de ce poisson sort nets. Dents présentes, nageoire adipeuse, mâchoire formeé par intermaxillaires [=premaxillaries] et maxillaires. C'est un *Characinidae* [=Characidae]. Il se rapproche des *Hydrocyoninae* mais il est à peu près impossible de la faire rentrer dans un genre connu." Of *Procharacinus arverniensis*, "Comme la précédente, cette espèce appartient d'une manière indiscutable à la famille des *Characinidae*,....Elle se rapproche également de la tribu des *Hydrocyoninae* sans qu'il soit non plus possible de la classer dans un genre connu." In his descriptions, Piton gave the usual body proportions and fin counts, but did not discuss the osteology. In reading Piton's text one receives the impression that he believed these fishes to be characids merely because they resembled the Cyprinidae (carp-like fishes) but had teeth on the jaws. This is especially apparent from statements in his introduction.

In his text and figures (drawings and legends) Piton made no reference to a Weberian apparatus, and I can find no evidence of one in either of the two photographs of the type of *Prohydrocyon pellegrini* (Figs. 1 and 2). Unless one knows characid cranial osteology very well and has excellently preserved fossils, it is risky to identify any fossil fish as a characid without first identifying a Weberian apparatus. The Weberian apparatus is not always easy to see in fossil characids, but it can often be detected by noting the presence of the neural complex, neural pedicle and short neural spine of the fourth vertebra (Weitzman, 1954, p. 252, fig. 10). I have had no difficulty in identifying these structures in Brazilian fossil characids from the lignite near Taubaté.

The premaxillaries of Piton's fishes are not quite like those of any

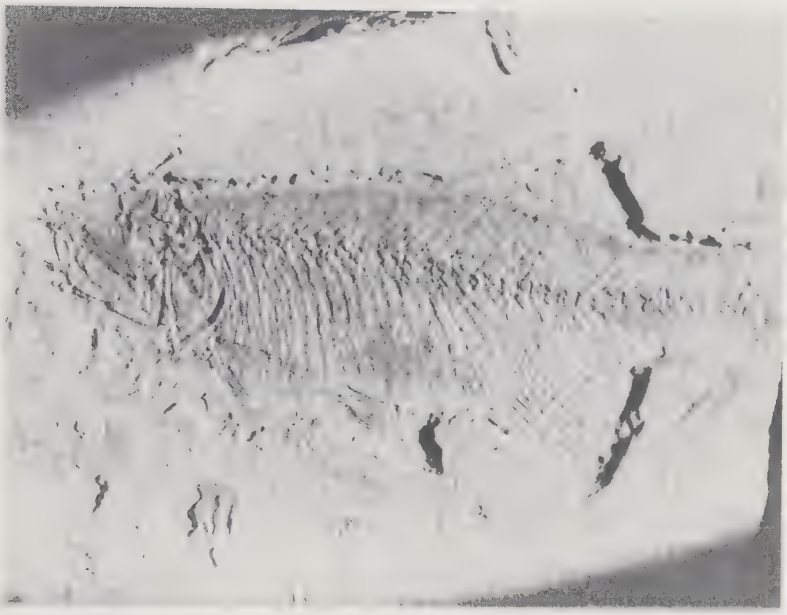

Fig. 1. *Prohydrocyon pellegrini*, Piton, holotype, length 80 mm.

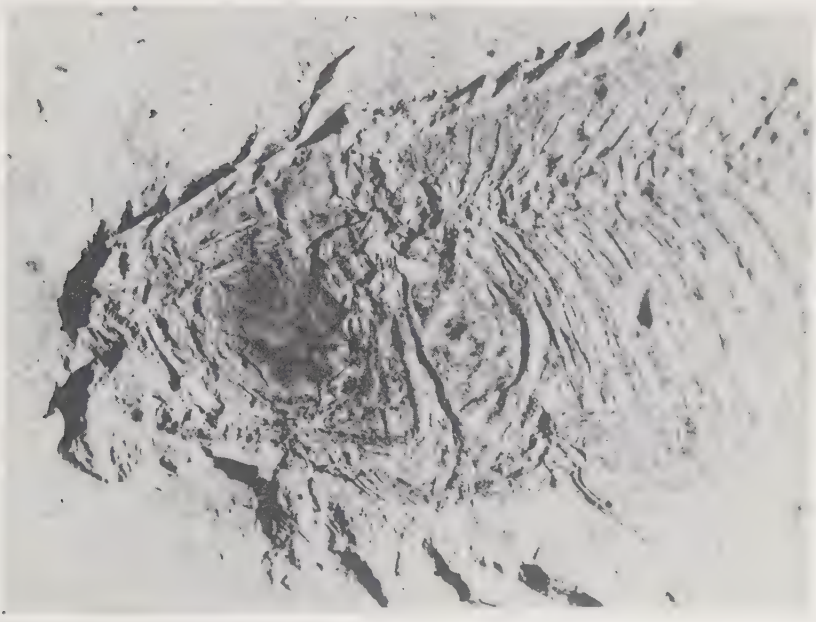

Fig. 2. *Prohydrocyon pellegrini*, Piton, holotype.

Recent characid. His published drawings of *Prohydrocyon* and *Procharacinus* show in both a long premaxillary, almost, if not completely, excluding the maxillary from the gape. A long, tooth-bearing, posterior process of the premaxillary accompanies the maxillary for most of its length. The photographs of *Prohydrocyon* indicate that Piton's drawings are probably relatively accurate with regard to this characteristic. The premaxillary of Recent American characids is almost always short, neither extending posteriorly along the gape, nor almost (if not completely) excluding the maxillary from the gape. In the few American characids in which the premaxillary almost excludes the maxillary from the gape, for example, *Serrasalmus*, *Mylossoma*, *Poecilobrycon*, and *Nannostomus*, it appears to be a specialization in which the premaxillary has increased in size at the expense of the maxillary. There is no long, tooth-bearing process of the premaxillary accompanying the maxillary for most of its length. In African characids, however, Boulenger (1901, pp. 132-135) noted that the maxillary is excluded from the gape in the specialized genera *Citharinus*, *Eugnathichthys*, *Phago*, *Ichthyborus*, and *Neoborus*. In addition, the morphologically conservative African genus *Alestes* has a long posterior process extending along about half to two-thirds the length of the inferior border of the maxillary. In some species of *Alestes* this process may be tooth-bearing. But the maxillary of *Alestes* is not mainly behind or above the premaxillary, as it appears to be in the photograph of *Prohydrocyon*. And in none of the above African characid genera are the premaxillaries and maxillaries shaped like those of *Prohydrocyon*, as illustrated in the accompanying photograph.

Piton gave no information about the teeth except their number and position on the jaws. He did not mention whether they are conical or multicuspid. His drawings show simple conical teeth; presumably this is why he compared his fossils with such characids as *Hydrocynus*, the latter having conical teeth. Myers (1958, p. 29) has suggested that multicuspid teeth on the jaws are probably primitive for characids. If this is true (and the evidence from living characids certainly indicates that it is) one might expect to find multicuspid rather than conical teeth in fossil characids. However, since little is actually known about the evolution of teeth in characids, there being almost no fossil record, it cannot be assumed that there were no characids with simple, conical teeth during the Eocene. Several species and genera of living characids have conical, unicuspid teeth, and such forms may have existed since the Eocene.

In examining Piton's drawings (apparently meant to be reconstructions), I was immediately struck by the very unusual morphological relationships of the bony elements. The drawings are so odd that it seems likely that Piton had little real knowledge of the teleost skull. Moreover, examination of the photographs of *Prohydrocyon* indicates that the errors in Piton's interpretations could not have been derived from moving and damage of bone elements during fossilization.

The drawings show an "occipital" where one would expect to find a parietal, the supraoccipital and the epiotic; a "nasal" where the ethmoid should be located; and an "ethmoid" in the position of the anterior half of the frontal.

In teleosts the metapterygoid is internal to the preopercle and the quadrate usually rests on the dorso-anterior portion of the anterior preopercular arm, never covering it extensively. In Piton's drawing the metapterygoid is shown as lying external to the preopercle, and the quadrate is shown as covering almost the entire preopercular arm. Although in Piton's figure of *Prohydrocyon* the "quadrate" covers the anterior arm of the preopercle, the photo of this specimen shows the external surface of the preopercle to be completely exposed.

The articular of teleosts is a single bone forming the posterior part of the lower jaw. Two large, very elongate articular bones, one placed post-

erior to the other, are shown in Piton's drawing of *Prohydrocyon pellegrini*. The posterior articular shown in Piton's figure lies inferior to the "quadrate", the latter being in reality the upper part of the anterior arm of the preopercle. As noted above, Piton's posteriorly placed articular appears to be nothing more than the inferior part of the anterior arm of the preopercle. The anterior articular in Piton's figure does lie in the usual position of the articular, but it is probably drawn too long, and the dentary too short. However, examination of the photograph (Fig. 2) gives little aid in determining the relative lengths of the dentary and articular.

SYSTEMATIC POSITION OF *PROHYDROCYON* AND *PROCHARACINUS*

From the above discussion, there seems to be no real evidence that *Procharacinus* and *Prohydrocyon* are characids. Is there any evidence of their true relationships? Fortunately there is. Although these fossils are greatly in need of reexamination, Piton's figures and descriptions, and especially the photographs at hand, suggest that these fishes are members of the Thaumaturidae, an extinct family of presumably salmonoid fishes.

Until recently, the genus *Thaumaturus* had been placed in the Salmonidae. Voigt (1934) described and defined the family Thaumaturidae, and on pages 57 to 62 he gave an account of the systematic relationships of this family. Berg (1940, p. 427) diagnosed the family Thaumaturidae, basing his diagnosis on Voigt's work, and following the latter's lead, assigned this family to the suborder Salmonoidei. However, some aspects of the osteology of the Thaumaturidae as described by Voigt lead me to wonder if the family is correctly placed. For example, the morphology of the maxillary and premaxillary bones, the apparent absence of an orbitosphenoid, and a tendency for the parietals to be separated from each other by the supraoccipital suggest a possible relationship with the haplomous fishes.[2] The relationships of the Thaumaturidae need to be investigated further.

According to Berg (1940, p. 477), members of the Thaumaturidae are known from the Lower Eocene to the Aquitanian [=Lower Miocene] of Western Europe. Piton's fossils were said to be from the Lutetian, which equals the Middle Eocene. This is well within the time-range of the Thaumaturidae. Voigt (1934) described members of the Thaumaturidae from the Middle Eocene Braunkohle of Geisetale, near Halle on the Saale River, in Saxony, Germany.

Voigt's drawings and photographs of *Thaumaturus spannuthi* Voigt show a striking resemblance to the photograph of *Prohydrocyon pellegrini*. Unfortunately, the photographs of *P. pellegrini* do not allow detailed examination of the few cranial characters given by Berg or of the several listed by Voigt. However, Berg stated that the maxillary has few teeth (apparently there are none in Piton's specimens), that it scarcely borders the mouth and that it is mainly situated behind the premaxillary, which does not reach the posterior end of the maxillary; this is true of Piton's figures and of the photograph of the holotype of *Prohydrocyon pellegrini*. Berg called the preopercle "crescent-like", but in Voigt's photographs and drawings (Voigt, 1934, text-fig. 13; pl. 1, fig. 2) it has an acute posterior angle; the preopercle in the photographs of *Prohydrocyon pellegrini* also has an acute posterior angle. Berg listed 40 to 42 vertebrae for members of the Thaumaturidae; Piton counted 40 for *Prohydrocyon*, and examination of the photograph indicates that he was probably correct. The fossil specimen of Piton's other genus, *Procharacinus*, was incomplete, and

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[2] In a paper (Gosline, 1960) received after the present contribution had been written, Gosline, p. 346, also notes that the Thaumaturidae may show more relationships with the haplomous fishes than with the salmonoids. Gosline based his statement primarily on examination of the caudal skeleton.

therefore no vertebral count was taken. The ribs of the Thaumaturidae were characterized by Berg as ossified, strong, nearly reaching the edge of the abdomen; this is true for *Prohydrocyon*, and Piton said that the ribs of *Procharacinus* are strong. Berg (p. 427) said: "Adipose fin described as wanting in Th. spannuthi Voigt and present in Th. intermedius Weitzel." Piton stated that one is present in *Prohydrocyon pellegrini*, but that it is detached from the specimen. The structure he refers to can be seen above the caudal peduncle in Figure 2.

One of the characteristic features of the Thaumaturidae (and its relatives) is the broadness and length of the frontal bones (Voigt, 1934, text-fig. 13; pl. 2, fig. 6); these are present in *Prohydrocyon*, as is well shown in Figures 1 and 2. Also, the general shape of the body in *Thaumaturus* (Voigt, pl. 1, figs. 1 and 2; pl. 14, fig. 2) is about the same as in *Prohydrocyon*. In both, the origin of the pelvics is midway between the origin of the pectoral and anal fins, and the anal origin is below the base of the fourth to the sixth dorsal fin ray.

Thaumaturus spannuthi has 13 to 16 dorsal fin rays, according to Voigt (p. 56); Piton counted 12 dorsal fin rays in *Prohydrocyon pellegrini*. I am unable to confirm Piton's count from the photographs reproduced here, but the number certainly cannot be less than 12. Voigt (p. 57) recorded 14 to 17 anal fin rays in *T. spannuthi*, and Piton recorded a total of 14 anal fin rays in *P. pellegrini*.

The principal caudal fin-ray counts and the caudal fin-ray structure are constant in many groups of living fishes. For example, of over 100 genera and over 200 species of Recent characids that I have examined, all have 19 principal rays - 10 in the upper lobe and 9 in the lower lobe of the caudal fin. Because of the constancy of the caudal fin-ray counts it would seem worthwhile to point out that caudal fin structure and caudal fin-ray counts of fossil fishes should be more carefully determined in the future.[3] Not infrequently these structures are well preserved and they may give excellent clues to the relationships of fossil fishes. Voigt (p. 57) gave 18 to 20 as the principal caudal fin-ray count for *T. spannuthi*; the count for *P. pellegrini*, which I cannot confirm, is a total of 22 principal rays. Piton's formula for the caudal fin count is "4,5-1-20-1-4,5", which I have interpreted as (starting dorsally and continuing ventrad on the fin): from four to five procurrent rays; one long, unbranched ray; 20 branched rays, one long, unbranched ray; four to five procurrent rays. The principal caudal fin-ray count is usually defined as the branched rays plus two (omitting, of course, the procurrent rays). This makes the count of 22 principal rays given above for Piton's specimen.

Lindsey (1955, p. 40) has noted that in *Thaumaturus* the "supraneural" series overlaps the pterygiophores of the dorsal fin, whereas in many other fishes these two series of bones are in a single, continuous series. In all the characid fishes that I have examined, the "supraneural" series and the pterygiophores are continuous, not overlapping. Unfortunately, I am unable to be sure of the presence of a "supraneural" series from the photographs of *Prohydrocyon*. However, when further examples of these fishes become available, the relationships of the "supraneurals" and pterygiophores should be carefully examined.

SUMMARY

In view of the facts discussed above it appears that there is no positive evidence for placing *Prohydrocyon* and *Procharacinus* in the Characidae. The apparent lack of a Weberian apparatus would seem to exclude both of them

[3] The recent study by Gosline (1960) on the caudal skeleton of isospondylous fishes amply reinforces this view.

from the Characidae. On the other hand, the jaw structure, the large size of the frontal, and the general osteological morphology indicates strongly that these fossil fishes of the Middle Eocene of Europe belong to the Thaumaturidae, a family of supposedly salmonoid fishes (but more probably haplomous fishes) well known from the Middle Eocene of Europe. Lack of direct examination of fossil material precludes a final decision that *Prohydrocyon* and especially *Procharacinus* are synonyms of *Thaumaturus*. However, it is quite possible that *Prohydrocyon*, at least, will prove to be the same as *Thaumaturus*.

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THE MORMYRID GENERA HIPPOPOTAMYRUS AND CYPHOMYRUS

By George S. Myers

The tropical African teleostean fishes of the family Mormyridae have long been famed among zoologists for the enormous size of the cerebellum and for their electrogenic organs. They produce regular electrical discharges, each fish maintaining an electrical field about itself, by means of which it seems to navigate and locate objects and other fishes. Each species so far tested has shown identifiably different discharges. The value of such an electrical system to the fish is probably great. Atz and Coates (1957) have given references to some of the recent literature on the subject and Lissmann (1958) has reviewed the function and evolution of electric organs in fishes.[1]

The generic classification of the Mormyridae, although unchanged by two generations of ichthyologists, is chaotic both zoologically and nomenclaturally. In fact, the generic names, if one tries to base them on the type concept, form a veritable Gordian knot which will take the utmost care to disentangle. Some of the best known generic concepts now go under names the obvious types of which are traditionally placed in other genera. Even the name *Mormyrus* itself is in this category.

The taxonomic classification is in equal confusion. Perhaps this is really fortunate, for any nomenclatural revision without an accompanying extensive taxonomic revision would be so clearly ill-advised as to preclude general acceptance. The system of classification and nomenclature still followed is the artificial one of Boulenger (1909), in which several separate and distinctive genera are lumped, and some of the genera accepted are only poorly defined. A nomenclatural revision, if accompanied by the necessary extensive upheaval of the currently recognized genera, might be

[1] The parallelism between the snout forms (and electrogenic properties) of mormyrids and gymnotids is stressed by Atz and Coates and by Lissmann. This has probably been pointed out previously. Two generations of advanced students in ichthyology at Stanford will recall my own references to the parallelism.

easier to accept than a mere juggling of names. Such a revision has been in progress for some time, but has not yet been completed. In the meanwhile, there seems to be no reason to withhold notes on *Hippopotamyrus* and upon a new genus that I have recognized.

Genus *HIPPOPOTAMYRUS* Pappenheim

Hippopotamyrus Pappenheim, 1906, p. 260 (original proposal and description; type species, by monotypy: *H. castor* Pappenheim).
Paramyomyrus Pellegrin, 1927, p. 297 (original proposal and description; type species, by monotypy: *P. aequipinnis* Pellegrin).

The history of this apparently monotypic genus illustrates the weakness of Boulenger's system of mormyrid classification. Pappenheim (1906; 1907) recognized *H. castor* as a distinct new genus and species of the family, from Cameroon. Boulenger (1909, p. 77) reduced Pappenheim's genus to the synonymy of *Marcusenius*, with the key characters of which *H. castor* disagrees in possessing a pair of enlarged median mandibular teeth, recalling somewhat those of *Myomyrus*. Nearly twenty years after Boulenger's revision, Pellegrin, who had had extensive experience with African fishes, obtained material of the same species, which he also recognized as representing a distinctive genus. However, because Boulenger had sunk Pappenheim's genus into *Marcusenius* in his "Catalogue of the Fresh-Water Fishes of Africa", Pellegrin found no obvious genus with which to identify his material, and described it as a new genus and species, *Paramyomyrus aequipinnis*. Pellegrin later figured his fish in a popular magazine (Pellegrin, 1932, p. 143). While Pellegrin should obviously have been more circumspect, the chief fault lies in the artificial nature of both Boulenger's keys and classification, two phases of systematics which that author often confused. It is also a comment on Holly's key to Cameroon fishes (Holly, 1930) that he recognized (p. 222) both "*Marcusenius castor*" and "*Paramyomyrus aequipinnis*" on the same page! Poll (1957, p. 93) still accepts *Paramyomyrus*. So far as I am aware, the identity of these two genera and species has not hitherto been pointed out. *Hippopotamyrus* may be diagnosed as follows:

Dorsal fin origin approximately opposite that of anal fin, the length of the two fins approximately equal. Body moderately elongated, the vertebrae less than 50 in number. Teeth in each jaw in a single series. Mouth definitely inferior in position, the lower jaw lacking a slender dermal appendage. Snout rounded. Median (symphysial) pair of teeth in lower jaw considerably larger than the others.

Only one species is known, *Hippopotamyrus castor*, from Cameroon, of which *Paramyomyrus aequipinnis* is a synonym.

Genus *CYPHOMYRUS*, novum

TYPE SPECIES: *Marcusenius psittacus* Boulenger.

Dorsal fin origin situated definitely anterior to anal fin origin. Dorsal fin with more rays than anal fin, and with its base longer than that of anal fin. Base of anal fin over half as long as base of dorsal fin. Mouth definitely inferior, or the chin with a short bulbous protuberance which hides the essentially inferior position of the mouth. Teeth present only in the middle of the jaws, the median symphysial pair in the lower jaw not greatly enlarged. Body compact, deep, compressed, predorsal profile of back convex or humped. Origin of pelvic fins closer to base of pectoral fin than to origin of anal fin. Gill openings restricted, not extending

below base of pelvic fin. Vertebrae 50 or fewer.

This genus, removed from the polyphyletic assemblage called *Marcusenius* by Boulenger, is an obviously compact phyletic entity. The deeper bodied species of *Cyphomyrus* greatly resemble marine carangids of the genus *Trachinotus*. Species:

Cyphomyrus wilverthi (Boulenger). Congo.
Cyphomyrus psittacus (Boulenger). Congo.
Cyphomyrus macrops (Boulenger). Congo.
Cyphomyrus discorhynchus (Peters). Zambezi, Tanganyika, Nyasa.
Cyphomyrus plagiostoma (Boulenger). Congo.
Also other species described subsequent to Boulenger's Catalogue.

The name is derived from *kuphos* (Greek), a hunchback, and *muros* (Greek), the often-used combining form of *mormuros*, a kind of fish, later transferred to the mormyr, an Egyptian mormyrid.

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NOTE ON THE FLATFISHES OF THE GENUS POECILOPSETTA OCCURRING IN ATLANTIC WATERS

By James C. Tyler

Difficulty has been encountered in identifying specimens of pleuronectid flatfish of the genus *Poecilopsetta* (Günther, 1880, p. 48) collected off the Guiana and Surinam coasts of South America by the United States Fish and Wildlife Service vessel "Oregon" and the M/V "Coquette", exploratory vessel of the government of Surinam. The three species of this genus which occur in the Atlantic Ocean are herewith discussed.

HISTORICAL SKETCH

The first species of *Poecilopsetta* described from the Atlantic was *P. beani* (Goode, 1881, p. 473), of rather common occurrence in the deep bottom waters of the continental shelf of the eastern and Gulf coasts of the United States. Goode placed this species in the genus *Limanda*, but it was later correctly referred to *Poecilopsetta* by Hubbs (1919, p. 163), primarily because *Limanda* has a developed lateral line on the blind side, while in *P. beani* it is obsolete on this side. The species agrees with *Poecilopsetta* in this and other characters of generic significance.

Subsequently Breder (1927, p. 86) described a new genus and species, *Paralimanda inermis*, from a single specimen taken in 484 fathoms off Glover Reef, British Honduras. The species was placed in *Poecilopsetta* by Norman (1931, p. 424) when he reviewed this group. *Poecilopsetta inermis*, whose specific name refers to its highly deciduous scales, was said to differ from *P. beani* in that the former has cycloid (rather then ctenoid) scales on the ocular side and a much greater body depth. *Poecilopsetta inermis* is known only from the type specimen, which can not be located at the Bingham Oceanographic Collection, where, according to Breder, it was Type No. 516.

The latest Atlantic representative of the genus to be described was *P. albomarginata* Reid (1934, p. 10), based on four specimens taken just north of Tobago Island in the Virgin Islands (approximately 18° 39′ N., 64° 51′ W.). *Poecilopsetta albomarginata* (like *P. inermis*) was distinguished from *P. beani* by its greater body depth; and from *P. inermis* principally in the ctenoid scales on the ocular side and the coloration of the dorsal and anal fins.

The more than 50 newly collected specimens of *Poecilopsetta* from the Guiana coast do not precisely agree with any of the three previously described species, all of which, together with the Guiana specimens, differ from the Pacific species of the genus by the lesser development of the dentition (Norman, loc. cit.). The following discussion of these three species will, it is hoped, clear up their relationships. Specimens studied are mainly from the collections of the U. S. National Museum, but also from the Stanford University Natural History Museum and the University of Miami Marine Laboratory.

Poecilopsetta beani (Goode)

The Guiana *Poecilopsetta* differ strikingly from *P. beani* in the depth of the body. Measurement of 45 Guiana *Poecilopsetta* shows the greatest body

depth to be 40-48 (43) percent of the standard length. Here, as elsewhere, measurements were taken to the nearest half millimeter and all percentages and averages are given to the nearest whole number; the average value for a count or measurement is given in parentheses following the range of variation of that character. Measurement of 30 specimens of *P. beani* from off the east and Gulf coasts of the United States shows the greatest body depth to be 29-38 (34) percent of the standard length (Table 2). Another character which helps to distinguish the two groups is the number of lateral line scales (Table 1), counted from a point on the lateral line just above the upper attachment of the operculum to the end of the caudal peduncle. Their number in 35 specimens of Guiana *Poecilopsetta* was 66-75 (70); in 27 specimens of *P. beani* 75-85 (79). The vertebral counts of the two groups overlap somewhat, but generally *P. beani* has several more caudal vertebrae (all of them posterior to, and including, the vertebra to which is attached the enlarged first interhaemal spine) than the Guiana *Poecilopsetta*, although all of the specimens of both groups had ten abdominal vertebrae (Table 3). The dorsal and anal fin-ray counts (Table 2) are of little value in separating the two groups, for the range of variation is almost the same, and the averages in the two groups are rather similar. In 45 Guiana *Poecilopsetta* the dorsal fin rays were 59-65 (62), the anal fin rays 51-56 (53). In 30 specimens of *P. beani* the dorsal fin rays were 60-67 (64), the anal fin rays 52-58 (55). Other meristic counts are likewise of little diagnostic value. In both groups all specimens examined had six pelvic fin rays on each side, and the caudal fin rays numbered 18, with the two uppermost and two lowermost unbranched and the remaining 24 branched. The number of pectoral fin rays is also of no value in distinguishing the two groups, for in *P. beani* these rays on the ocular side number 8-11 (9) and on the blind side 7-10 (8). In Guiana *Poecilopsetta* there are, on the ocular side, 8-11 (9) pectoral fin rays, and on the blind side 7-11 (8). The number of gill rakers on the lower limb of the first arch is the same in both groups, there being 9-11 (10). Other qualitative and quantitative characters are essentially the same. Thus *P. beani* and the Guiana *Poecilopsetta* can be distinguished from one another primarily on the basis of body depth and number of lateral line scales.

Poecilopsetta inermis (Breder)

Since the only known specimen of this species is lost or unobtainable, it is possible only to compare the Guiana specimens with the description and figure given by Breder. This species differs most notably from the other Atlantic species of *Poecilopsetta* in the cycloid scales of the ocular side and in the absence of any teeth on the ocular side of the jaws. It differs from *P. beani*, and agrees with the Guiana *Poecilopsetta*, in its body depth (Table 2), which is 2.3 times in the standard length. This figure, corresponding to 43 percent, is well above the highest value in the range of variation for this measurement in *P. beani*, and in the middle of the range of variation for the Guiana *Poecilopsetta*. Breder stated that his new species also differed from *P. beani* by "its much larger head," whose length he specified as 4.3 in the standard length (or 23 percent). Taking the measurement of the head length of 30 specimens of *P. beani* in the same manner as Breder had done on *P. inermis*, from the tip of the lower jaw to the end of the bony operculum, the values of this measurement are 20-23 (21) percent of the standard length. Breder's value for the head length of *P. inermis* corresponds to the higher figure in the range of *P. beani*; therefore this character will not serve to differentiate the two species. The head length of the Guiana *Poecilopsetta* averages slightly longer than that of *P. beani* - it being 21-25 (23) percent of the standard

Number of Scales	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
P. beani	-	-	-	-	-	-	-	-	-	-	-	-	1	5	4	3	2	3	5	-	1	2	1
P. albomarginata (Guiana)	-	-	-	3	3	3	6	8	2	4	3	1	2	-	-	-	-	-	-	-	-	-	-
P. albomarginata (types)	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. inermis (type description)	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 1. Atlantic species of *Poecilopsetta*. Lateral line scale frequencies.

Percent of Standard Length	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
P. beani	1	-	1	4	5	3	6	7	1	1	-	-	-	-	-	-	-	-	-	-
P. albomarginata (Guiana)	-	-	-	-	-	-	-	-	-	-	-	1	7	11	13	3	6	3	-	1
P. albomarginata (types)	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	1	-	-	-	-
P. inermis (type description)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-

Table 2. Atlantic species of *Poecilopsetta*. Body depth in standard length.

Counts	Dorsal fin rays 59	60	61	62	63	64	65	66	67	Anal fin rays 51	52	53	54	55	56	57	58	Vertebrae (abdominal-caudal) 10-29	10-30	10-31	10-32	10-33
P. beani	-	2	-	2	6	8	8	2	2	-	1	5	8	6	7	2	1	-	-	11	24	2
P. albomarginata (Guiana)	1	2	15	16	7	3	1	-	-	7	14	17	5	1	1	-	-	4	32	18	6	-
P. albomarginata (types)	1	1	-	-	-	1	-	-	-	2	-	-	1	-	-	-	-	-	1	2	-	-
P. inermis (type description	-	-	-	1	-	-	-	-	-	-	-	1	-	-	-	-	-					

Table 3. Atlantic species of *Poecilopsetta*. Dorsal and anal fin-ray counts and vertebral counts.

length in the 42 specimens examined. It can be noted that the average value of the head length of the Guiana *Poecilopsetta* is the same value as that of the type specimen of *P. inermis*. Breder's description of *P. inermis* gave the following meristic counts: dorsal 62, anal 53, lateral line scales 63, gill rakers on the lower limb of the first arch 11. Except for the number of lateral line scales, all these values fall within the respective ranges of variation for these characters in both *P. beani* and the Guiana *Poecilopsetta* (Table 1). The number of lateral line scales in *P. inermis* is obviously far less than in *P. beani*. It is only three less than the lowest number in the lateral line of the Guiana *Poecilopsetta* (Table 1), but it is problematical whether this difference would hold true if more specimens of *P. inermis* were available or if the respective lateral line counts were taken in precisely the same fashion. Nevertheless, it should be possible to distinguish any future specimens of *P. inermis* from the other Atlantic *Poecilopsetta* solely on the basis of the type of scales (cycloid) on the ocular side, and the character of the dentition (no teeth on ocular side of jaws).

Poecilopsetta albomarginata Reid

This species has been known only from the four specimens on which Reid based his species description. The holotype (USNM 93303) and two paratypes (USNM 93304) were examined, but the other paratype is in the British Museum and has not been seen. This species can be distinguished from *P. beani* by the depth of the body (Table 2), which in the three specimens examined was 40-44 (42) percent of the standard length, or about the same body depth as *P. inermis* and the Guiana *Poecilopsetta*, and far deeper bodied than *P. beani*. *Poecilopsetta albomarginata*, like *P. inermis* and the Guiana *Poecilopsetta*, has far fewer lateral line scales than *P. beani* (Table 1). It is possible, then, to distinguish both *P. albomarginata* and the Guiana *Poecilopsetta* from *P. beani* on the basis of body depth and lateral line scale counts, and from *P. inermis* on the basis of dentition and type of scales on the ocular side. It remains only to show the relationship of the Guiana *Poecilopsetta* and *P. albomarginata*. Both, in fact, are essentially similar in all respects except coloration. Their body shapes and proportions, and fin lengths and heights, are the same. The three specimens of *P. albomarginata* have dorsal and anal fin-ray counts and lateral-line scale counts within the range of the respective counts taken from the Guiana *Poecilopsetta*, (Tables 1 and 3). The pectoral fin rays of *P. albomarginata* vary between eight and nine on each side, and again these counts are within the range of similar counts from the Guiana *Poecilopsetta*. This is also true of the number of gill rakers on the lower limb of the first arch, which are 10 in one specimen of *P. albomarginata* and 11 in the other two; and of the number of vertebrae (Table 3). It is only in the coloration, particularly that of the dorsal and anal fins, that a distinction can be made between the two groups. The body of the Guiana *Poecilopsetta* is dark tan to brown, while that of *P. albomarginata* is light tan. In *P. albomarginata* the dorsal and anal fins are colored throughout their lengths in the following sequence from proximal to distal edges: light tan along the bottom half of the fin, above this a white or cream-colored area extending almost to the distal edge, the edge becoming slightly darker than the middle cream-colored area below it. In the Guiana *Poecilopsetta* these fins are tan along the bottom two-thirds but become paler along the distal edge. The transition between the tan main portion and the pale distal third of the fin in the Guiana examples is a gradual change and does not have the quality of a definite alternation of a tan and cream-colored area as is found in *P. albomarginata*. The pale distal edges of the dorsal and

anal fins in the Guiana material seems to be due to a lack of pigment in this area, whereas in *P. albomarginata* the cream-colored band in these fins seems to be due to the presence of a whitish pigment. Reid did not mention the presence in his specimens of the black spots that characteristically occur in four longitudinal rows on the blind side of *P. beani, P. inermis* and the Guiana specimens. The three type specimens of *P. albomarginata* show these spots on the blind side, although they are ill defined and rather inconspicuous. Since these spots are well developed on the blind side of the Guiana material it may be that another color distinction can be made between this group and *P. albomarginata*. However, it is difficult to say whether this difference in the intensity of the spotting on the blind side is a real difference in nature or only the effect of differential preservation and bleaching.

SUMMARY AND CONCLUSIONS

Since the Guiana *Poecilopsetta* and the type specimens of *P. albomarginata* differ only in certain aspects of coloration and are identical in all other respects, the Guiana specimens are here considered to be *P. albomarginata*. On the basis of depth of capture records this species is known only from waters 100 to 300 fathoms deep. Since there are troughs of greater than 300 fathoms depth occurring between various island groups in the Lesser Antilles, which connect the type locality and the Guiana coast of South America, one might suppose, if the species does not venture far beyond its lowest known depth record, that there are relatively sharp geographic discontinuities in the species total population. In this case it would not be unexpected if it were found that *P. albomarginata* could be divided into subspecies. However, Bruun (1937, p. 131) has shown that *Poecilopsetta* has bathypelagic premetamorphosed and metamorphosed juvenile stages. Among the "Dana" collections he found nine young *Poecilopsetta* specimens, four of which are Atlantic. Only two of his Atlantic specimens had locality data, one was taken about 300 miles N. W. of Havana, Cuba, and the other about 500 miles N. E. of the mouth of the Amazon River. Both specimens were between 30 and 40 mm. total length and were captured at between approximately 50 and 200 fathoms in water over 500 fathoms deep (see Bruun, loc. cit., for precise data). The specimen taken north of Cuba, in which both eyes are on the right side, is undoubtedly *P. beani* while the specimen taken off N. E. Brazil, in which the migration of the left eye is not yet complete, is probably *P. albomarginata*.

It is thus seen that speculation concerning distributional discontinuities based on lowest known depth record in *P. albomarginata* may lead to error, for the bathypelagic young stages may well cross the deep water troughs in the Lesser Antilles that are probable barriers to the bottom-living adults. For this reason it is quite possible that on the basis of more extensive collections of *Poecilopsetta* from the Antilles it will be shown that the total population of *P. albomarginata* is not divisible into subspecies.

Distribution of Atlantic *Poecilopsetta* (adult)

Poecilopsetta beani: Atlantic Ocean and Gulf of Mexico from New York along the eastern and Gulf coasts of the United States to Campeche, Mexico, and probably extending into the Greater Antilles, 50-240 fathoms. *Poecilopsetta inermis*: known only from the type specimen taken off British

Honduras, 484 fathoms. *Poecilopsetta albomarginata*: type locality off Tobago Island, Virgin Islands between 100-300 fathoms; specimens also recently taken between the northernmost coast of Brazil and the eastern coast of Venezuela, 100-225 fathoms.

Key to Atlantic *Poecilopsetta*

1a. Scales on ocular side ctenoid.
 2a. Greatest body depth less than 39 percent of standard length; scales in lateral line 75 to 85.....*P. beani.*
 2b. Greatest body depth more than 39 percent of standard length; scales in lateral line 65 to 75.....*P. albomarginata.*
1b. Scales on ocular side cycloid.....*P. inermis.*

ACKNOWLEDGEMENTS

I wish to express my thanks to Dr. Giles W. Mead, U. S. Fish and Wildlife Service, for making available to me the Guiana material, and to Dr. C. Richard Robins for the loan of *Poecilopsetta* specimens in the collections of the University of Miami Marine Laboratory. My thanks are also due to Dr. George S. Myers, Stanford University, for his comments on the manuscript.

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THE GENERA AND ECOLOGICAL GEOGRAPHY OF THE SOUTH AMERICAN BANJO CATFISHES, FAMILY ASPREDINIDAE

By George S. Myers

The recent capture of an aspredinid catfish[1] during marine trawling operations off the Guiana coast has caused considerable interest among ichthyologists, especially in regard to the necessary inclusion of the group in a forthcoming part of "Fishes of the Western North Atlantic". Having been assigned, with Dr. Stanley Weitzman, the task of preparing an introductory section on the Ostariophysi for that work, I have surveyed the literature on the two catfish groups (Ariidae and Aspredinidae) which enter the sea along the Atlantic coasts of the Americas. The records show that most of the Ariidae, as elsewhere, enter brackish or salt water, and few or none in this area penetrate far into fresh water. The aspredinids, which I have hitherto called bunocephalids, have been known for a long time to enter brackish water, but as most members of the family are primary fresh-water fishes, no one has paid much attention to the fact, or to the general distribution of the group. What I have discovered about the fresh-water and marine distribution of one subfamily, however, is most surprising, and has never previously been set forth. Moreover, the nomenclature and classification of some of the genera have been unclear, and even the correct family name has been in doubt. The present paper attempts to fill these gaps in our knowledge.

The family is a small one, confined to the Atlantic slope of South America. It has been generally accepted as a family distinct from the Siluridae since 1871, long before most of the other catfish families received general recognition. Recognition was based upon one supposed characteristic. The opercular bone was held to be missing in this group by Cope (1871, p. 454). This misinformation was repeated as recently as 1904 (Boulenger, 1904, p. 596), but the presence of a very small operculum was reported by Eigenmann as early as 1892.

There are two subfamilies, Aspredininae and Bunocephalinae, each so distinct from the other in anatomy and distribution that a question immediately arises as to whether they should be recognized as different families. Characteristically, Jordan (1923, p. 151) split the group into two families, but put one genus (*Agmus*) in the wrong group. Pending a much needed anatomical reinvestigation of these fishes, I prefer to retain them in a single family.

Family ASPREDINIDAE Cope

ASPREDINIDAE Cope, 1871, p. 454 (diagnosis; family name).—Gill, 1872, p. 19.—Boulenger, 1904, p. 596.—Eigenmann, 1912, pp. 119, 120 (diagnosis; revision of Guiana genera and species); 1923, p. 26 (review of Transandean forms).

BUNOCEPHALIDAE Eigenmann and Eigenmann, 1888, p. 647; 1890, pp. 9, 12 (nomenclature; diagnosis; revision of known genera and species).—Regan, 1911, p. 574 (diagnosis; osteology).—Myers, 1942, pp. 94-97 (discussion; key to known genera).

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[1] To be reported by Dr. W. R. Taylor.

The name to be accepted for this family depends upon two matters, the nomenclature of the genus called *Aspredo*, and the generally followed rule that the earliest familial designation, based upon a currently valid included generic name, is the correct name of the family. Cope was the first author to recognize the group unequivocally as of full familial rank, and he used the name Aspredinidae. Eigenmann and Eigenmann (1890, p. 20) recognized only one genus of the subfamily which possesses a long anal fin and sank *Aspredo* in the synonymy of *Platystacus*, thus killing the family name Aspredinidae. They proposed Bunocephalidae instead. Eigenmann (1910; 1912) split the group with a long anal fin up into four genera, thus re-establishing *Aspredo* as a currently accepted genus, and re-establishing the family name Aspredinidae.

It now appears that the name *Aspredo* is available as of a date preceding that of *Platystacus*, so there never was any real reason for sinking *Aspredo* in the synonymy of the latter genus, and therefore no reason for using the name Bunocephalidae. (It is, however, available as a subfamily name for the group with a short anal fin.) It also follows that the subfamily name Platystacinae of Eigenmann and Eigenmann falls in favor of Aspredininae.

The distributions of the two subfamilies contrast greatly. The Bunocephalinae (Eigenmann, 1912; Myers, 1942) have a strictly inland, freshwater distribution throughout tropical South America east of the Andes, ranging from Venezuela to Northern Argentina. They are also present in the isolated basins of the Río Magdalena and Lake Maracaibo.

The Aspredininae, on the other hand, have a greatly restricted distribution of sharply different type. They are fishes of the lowland, muddy coast of Guiana and Amazonia, where they occur in the sea, in brackish water, and in the estuaries and tidal portions of rivers. They do not seem to be found far inland anywhere, except in the lower Amazon, where they apparently occur in many (or all) parts of the vast, complicated delta area, where the tides or tidal bores (*pororoca*) are felt.

The breeding habits are not well known. Wyman (1859), Vaillant (1898), Puyo (1949) and others have described egg-carrying females of different species of Aspredininae. The eggs are carried attached singly to the belly of the female, as figured by Bloch (1797, pl. 372). Aquarists have reported *Bunocephalus* to carry the eggs in the same way.

According to Eigenmann (1912, p. 120) and Roth (1943, pp. 12, 268), the native name for Aspredininae in British Guiana is "banjaman" or "banjo-man", because the fishes bear a resemblance to a banjo. For exactly the same reason, hundreds of thousands of tropical aquarium-fish enthusiasts in the United States know the aspredinids as "banjo cats". It is probable that the several aquarium-fish exporters in Georgetown originally introduced the name into North America. In French Guiana, Puyo (1949, p. 267) gives the local name for all aspredinids as "croncron". I do not know the meaning of this word but suspect it may be an onomatopoetic creole term for a banjo. On the north coast of Brazil, aspredinids are known as "rabeca", that is, a fiddle or violin. I do not know what terms are used for aspredinids in the Orinoco delta or in Surinam. It would appear that "banjo catfishes" is the obvious vernacular name to apply to aspredinids.

The banjo catfishes, at least the euryhaline Aspredininae, some of which reach nearly half a meter in length, have some economic importance as foodfishes. As suggested below, in recent years the airplane traffic in tropical aquarium fishes, now having a value of several million dollars per year, brings thousands of small banjo catfishes into the United States annually. Most of them belong to the genus *Bunocephalus*, but *Agmus* has also been imported.

Key to the Subfamilies, Tribes and Genera

1a. Anal fin short, of 12 or fewer rays. (Subfamily Bunocephalinae.)
2a. Body lacking prominent longitudinal series of bony scutes or plates; dorsal fin with 2 to 5 rays. (Tribe Bunocephalini.)
3a. Both anterior and posterior edges of the pectoral fin spine set with stout spines; dorsal fin with 5 rays; caudal peduncle relatively slender.
4a. Head depressed and rugose, its greatest depth equal to about half its greatest width.....*Bunocephalus.*
4b. Head deep and excessively rugose, its greatest depth about equal to its greatest width.....*Agmus.*
3b. Anterior edge of spine of pectoral fin relatively smooth, without strong spines.
5a. Dorsal fin very small, with only 2 rays; head very rugose, broad, and depressed, its greatest depth less than the depth of the very deep caudal peduncle; lower lip not fringed.....*Amaralia.*
5b. Dorsal fin with 5 rays; head relatively smooth; caudal peduncle slender; lower lip with a fringe of fine barbels directed forward.....*Xylophius.*
2b. Body with six longitudinal series of bony scutes, the 2 dorsal and 2 ventral series forming a compact armor above and below the tail, the lateral line series on each side formed of much smaller scutes; dorsal rays 7; pelvic fins originating before dorsal fin. (Tribe Hoplomyzontini.).....*Hoplomyzon.*
1b. Anal fin low and excessively elongate, of 50 or more rays. (Subfamily Aspredininae.)
6a. A series of barbels or small tentacles extending from each corner of the mouth along breast and anterior part of abdomen.
7a. Tips of snout smooth, the ethmoid without hooks; a single pair of mental barbels or sometimes none.....*Chamaigenes.*
7b. Tip of snout (nasals and ethmoid) with four broad hooked spines; a pair of mental and a pair of postmental barbels.....*Aspredinichthys.*
6b. Breast and head not margined with barbels; maxillary barbel adnate.....*Aspredo.*

Subfamily BUNOCEPHALINAE

The members of this subfamily have a general distribution throughout all or practically all of the major river systems of tropical South America east of the Andes, from Venezuela to eastern Brazil, Uruguay and northern Argentina. In addition, they are present in the streams of the transmontane basins of Lake Maracaibo in Venezuela and the Río Magdalena in Colombia. The majority of the species inhabit streams at relatively low altitude, and are found principally in shaded forest brooks, caños, or igarapés. They may be expected in any stream from the base of the Andes to the sea. However, they apparently all like some current, and occur in or near riffles or rapids, in the lowlands and even on the Guiana Plateau.

In the streams of the Maracaibo Basin, and in adjacent transmontane streams in the northeastern Magdalena Valley, the subfamily is represented by the very small fishes of the genus *Hoplomyzon*, which are adapted to swift water and have some of the same modifications shown by hill-stream catfishes (*e. g.*, *Astroblepus*, *Exostoma*, etc.) of other families, the lower surfaces being very flat, the enlarged pectorals and the pelvics set in the horizontal plane, and the head and maxillary barbels also modified to help maintain position against a strong current.

So far as known, no members of this subfamily ever enter either tidal or brackish water. They are primary fresh-water fishes (see Myers, 1938; 1949).

Genus *BUNOCEPHALUS* Kner

Bunocephalus Kner, 1855, p. 95 (original proposal; two species included: *Platystacus verrucosus* Bloch and *Bunocephalus hypsiurus* Kner; genus first dismembered by Bleeker, 1858, p. 329, who left only *hypsiurus* in *Bunocephalus* and proposed new genus *Bunocephalichthys* for *verrucosus* and *B. gronovii*, n. sp.; later, Bleeker, 1862, p. 19, reversed himself and for the first time selected *verrucosus* as type of *Bunocephalus*).

Bunocephalichthys Bleeker, 1858, p. 329 (original proposal; two species included: *Platystacus verrucosus* Bloch and *Bunocephalus gronovii* Bleeker; the first type designation was by Eigenmann and Eigenmann, 1890, p. 13, but they selected neither of the two original species; type *P. verrucosus* Bloch by subsequent designation of Jordan, 1919, p. 279).

Dysichthys Cope, 1874, p. 133 (original proposal; type species by monotypy: *D. coracoideus* Cope).

Pterobunocephalus Fowler, 1943, p. 1 (original proposal; type species, by original designation: *Bunocephalus albifasciatus* Fowler).

This genus comprises over half the known species of the entire family. The range is co-extensive with that of the family, except for the streams of the Maracaibo Basin, where *Hoplomyzon* alone is recorded, and the muddy tidal and coastal waters from the Orinoco to Maranhão, where the Aspredininae occur.

The species are all small in size, usually under 150 mm. in length, and appear to be partial to smaller streams shaded by the rain forest. Gosline (1945) has listed the species. They have become an important article of commerce since World War II, many thousands being shipped alive annually to North America, by air, for sale as aquarium fishes. At present the principal areas fished for them are in British Guiana and the Amazon Basin in the area of Leticia and Tabatinga (Peru, Colombia and Brazil).

Genus *AGMUS* Eigenmann

Agmus Eigenmann, 1910, p. 379 (original proposal; type species, by original designation: *Bunocephalus scabriceps* Eigenmann and Eigenmann); 1912, p. 128 (description).

This genus is close to *Bunocephalus* but is easily recognizable. Small numbers have recently been imported into the United States by aquarium supply dealers. There are only two species, the type and *A. lyriformis* Eigenmann (1912, p. 128). Both species are small in size. The genus is known only from the Amazon in Brazil (*A. scabriceps*) and from British Guiana (*A. lyriformis*). This genus must date from 1910, not 1912 (see similar case under *Chamaigones*, below).

Genus *AMARALIA* Fowler

Bunocephalichthys Auctorum (in error).

Amaralia Fowler, 1954, p. 40 (original proposal; type species by original designation: *Bunocephalus hypsiurus* Kner).

The single known species has been seen by very few ichthyologists; I have seen but one example, perhaps the first obtained since the types. *Amaralia hypsiura* is known only from the highly acid waters of the Rio Negro Basin in northern Brazil. The types were about 150 mm. in length.

Genus *XYLIPHIUS* Eigenmann

Xyliphius Eigenmann, 1913, p. 10 (original proposal; type species by monotypy: *X. magdalenae* Eigenmann).

This genus is known only from the type specimen, now in Chicago, and a very few examples taken by Mr. Cecil Miles, now of the United Nations Food and Agricultural Organization, Fisheries Division. One of Miles' examples is at Stanford. The single known species, which according to Miles (1947, p. 55), attains about 150 mm. in length, is confined to the Río Magdalena Basin in Colombia. The genus has been treated only by Eigenmann (1913; 1923) and Miles (1942; 1947).

Genus *HOPLOMYZON* Myers

Hoplomyzon Myers, 1942, p. 94 (original proposal; type species by original designation: *H. atrizona* Myers).
Dupouyichthys Schultz, 1944, p. 244 (original proposal; type species by original designation: *D. sapito* Schultz).

This genus is confined to swift streams of the Lake Maracaibo Basin, and to some of the adjacent streams in Colombia which flow to the westward. As noted above, these fishes are highly adapted for life in swift water. There are only two species known, *Hoplomyzon sapito* (Schultz) and *H. atrizona* Myers, which differ only in the fringing papillae and barbels of the lips (present in the first-known species, *H. atrizona*, absent in *H. sapito*) and slightly in the number of bony scutes on the body. The species have a closely similar color pattern, a yellowish body marked with blackish, zone-like blotches. Both are small fishes, reaching only 30 or 35 mm. Miles (1947) is responsible for the Colombian records.

Subfamily ASPREDININAE

As emphasized above, the four members of this subfamily are not freshwater fishes. They are euryhaline forms, entering fresh water only in estuaries and within tidal influence. The subfamily is strictly endemic to the *Guiana Mangrove Province*, an almost unbroken 1700-mile stretch of low-lying, muddy, mangrove-fringed coast, extending from the Orinoco delta in Venezuela into the Brazilian state of Maranhão. The Guiana Mangrove Province, and the range of the Aspredininae is bounded to the west by the high Venezuelan coast west of Trinidad Island, and to the east by the sandy coast of the Brazilian state of Ceará. I have seen the entire Province from the air and can say that it is essentially similar throughout and that its western and eastern boundaries are sharp, even though there are occasional small, isolated mangrove areas dotting the Brazilian coast as far south as Florianopolis. The Province is defined, so far as fishes go, not only by the ranges of the four species of Aspredininae, but also by those of several species of ariid catfishes, which frequent the same semimarine habitat. This Province is also notable as delimiting the entire South American range of the genus *Anableps*, two species of the genus (*A. anableps*,

A. microlepis) being confined to this Province. This is also true of the remarkable poeciliid fish *Tomeurus gracilis* Eigenmann, which has been recorded only in the Guiana Mangrove Province, from the Orinoco delta to Pará. It is probable, however, that neither *Anableps* nor *Tomeurus* enter salt water, although they seem to be restricted to waters showing tidal influence.

Genus *CHAMAIGENES* Eigenmann

Chamaigenes Eigenmann, 1910, p. 380 (original proposal; type species by original designation: *Aspredo filamentosus* Cuvier and Valenciennes); 1912, p. 120 (description).

The generic name must date from 1910, not 1912, for previous to 1930 only a type designation was needed to validate a generic name.

The genus contains only a single species, *Chamaigenes filamentosus*, which, according to Puyo (1949, p. 37), is a fish "which lives only in salt water strongly charged with alluvium". He says it is caught most commonly in the Chinese fish traps (coastal traps made of stakes driven in the mud in tidal areas). Eigenmann (1912) records specimens up to 205 mm. in length. It is a common market fish along the Guiana coast.

Genus *ASPREDINICHTHYS* Bleeker

Aspredinichthys Bleeker, 1858, pp. 328, 329 (original proposal; definition; type species by monotypy: *Aspredo tibicen* Cuvier and Valenciennes).

This genus also is monotypic, containing only *A. tibicen*. Eigenmann (1912, p. 122) states that it is the commonest of the banjo catfishes in the Georgetown fish market, where he obtained examples over 200 mm. in length. The species is known from the Brazilian coast as well.

Genus *ASPREDO* (Gronow) Scopoli

Aspredo Gronovius, 1763, p. 102 (three species included; non-bionomial; not accepted by International Commission on Zoological Nomenclature).

Aspredo Scopoli, 1777, p. 453 (diagnosis; based on Gronovius; no species mentioned; typé species by absolute tautonymy: *Silurus aspredo* Linnaeus, 1758).—Bleeker, 1858, pp. 328, 329 (diagnosis; included species).

Platystacus Bloch, 1794, p. 52 (original proposal; not seen); 1797, p. 42 (four species included; type species: *Platystacus cotylephorus* Bloch, by subsequent designation of Bleeker, 1862, p. 19).

Cotylephorus Swainson, 1838, p. 354 (original proposal; only one species mentioned; type species by monotypy and by absolute tautonymy: *C. blochii* Swainson, equals *Platystacus cotylephorus* Bloch); 1839, pp. 189, 308 (further diagnosis and identification of type species).

The smooth-breasted banjo catfishes, of which there are only two species, do not seem to form more than a single genus. Van der Stigchel (1947), who has examined the unique type of *Platystacus nematophorus* Bleeker, (1864) in Leiden, pronounces it to be a male of *A. cotylephorus*. He also sinks *Aspredo sicuphorus* Cuvier and Valenciennes in the synonymy of *A. aspredo*, an act which had already been suggested by Eigenmann (1912, p. 124).

Aspredo aspredo is a common market fish in Guiana, reaching 424 mm. (Van der Stigchel, 1947, p. 12). Apparently *A. cotylephorus* does not reach such a large size.

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FIGURES AND DESCRIPTIONS OF FOUR SOUTH AMERICAN CATFISHES OF THE GENUS CORYDORAS, INCLUDING TWO NEW SPECIES

By Stanley H. Weitzman

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New catfishes of the genus *Corydoras* seem to be making their appearance almost every year. Gosline (1940) admitted 33 distinct species. Since then about 20 nominal species have been proposed and one old name, *Corydoras triseriatus*, which had been placed in synonymy by Regan (1912), has been shown to be applicable to a valid species (Weitzman, 1955). Of the approximately 20 recently described species, probably about two thirds are valid, bringing the total number of valid species to almost 50. Several of the newer species have been described from aquarium specimens without certain locality. Fortunately most of these have been described by ichthyologists and the descriptions are recognizable. On occasion ichthyologists have remarked to me that it is poor practice to describe new species of fishes without locality data. In general I most certainly agree with this. However, I believe that it is better to have a new species of aquarium fish, even with incomplete data, described adequately by someone with ichthyological training than to have it described inadequately by someone without such training. A good description of a new species of fish without a locality is far better than a poor or unrecognizable description even with a locality.

Most of the recently described species of *Corydoras* have been illustrated, but some of them only by poor photographs in aquarium magazines. Their descriptions are scattered through both zoological papers and the popular aquarium literature. Much of the aquarium literature is not easily available to ichthyologists. Moreover, some of the species of *Corydoras* that were described 20 to 75 years ago have never been illustrated. This paper, as well as that of Weitzman (1956) and of Myers and Weitzman (1960) belongs to a series of papers in progress in which the primary objective is to illustrate and describe in a comparative manner every valid species of the genus *Corydoras* that is available to me. It is my hope to publish adequate representations and comparative descriptions of all the species of *Corydoras*. This series should help to prevent the establishment of invalid names in the future and to clarify our knowledge of this interesting genus.

Of the following four species of *Corydoras*, the specimens of the first, *habrosus* (apparently a pygmy species), are the only ones with certain locality information; they formed part of a collection of Venezulean *Corydoras* sent to me by Mr. Franz Weibezahn of the Universidad Central de Venezuela. Two of the paratypes are to be returned to him and deposited in the collection of the Museo de Biologia, Universidad Central de Venezuela, Caracas. Most of the other material used in this report is from aquarium importations and one of the species, *sychri*, is based on a single example. Several live examples of this species were seen previous to the time when I decided to describe and redescribe all available species of *Corydoras*. Unfortunately only one specimen was available at the time the decision was made. *Corydoras acutus* Cope (1872) has heretofore been illustrated at least twice and perhaps three times. Two of these three illustrations (one questionable) have appeared in aquarium literature. One of these, that of Weitzman (1959), is a reproduction of a Kodachrome of the same specimen illustrated here. The other, that of Innes (1935 and later editions), is a

retouched photograph of a species of *Corydoras* labeled as *Corydoras agassizi* Steindachner. I can only questionably identify it as a photo of *acutus*. The third illustration, that of a faded specimen from the Río Pacaya region, was described in Eigenmann and Allen (1942) as a new species, *Corydoras stenocephalus*. Gosline (1945) indicated that it is a synonym of *acutus* and after examining the type, California Academy of Sciences number CAS(IUM) 15817, I concur with this opinion. Previous to the description of *stenocephalus* the only recorded specimens other than Cope's original types are those reported but not illustrated by Gosline (1940). Gosline noted that Cope's specimen (or specimens) is now apparently lost. Both Gosline's and Cope's specimens came from the Río Ampiyacu. I have examined Gosline's material and the specimen illustrated here agrees well with those described by Gosline. Cope noted that his specimen had a large dorsal fin spot. Those examined by Gosline display a wide variation in dorsal fin spotting. However, none has as intensive and extensive a spot as the specimen figured here. The holotype of *stenocephalus* is without a dorsal spot but the specimen is faded. An aquarium specimen has been used to illustrate the species primarily because its melanophore pattern is preserved well and its life colors were recorded.

Corydoras griseus Holly (1940) was described without a figure, but a poor photograph was published by Schultze (1939), and a sketch was presented by Holly (1949). This form is probably a geographical variation of *Corydoras potaroensis* Myers (1927). The latter has been little known in American aquaria and has, so far as I know, not been noted in any English language aquarium literature. The species was well figured by a retouched photograph published by Eigenmann (1912, pl. 24, fig. 3). The retouched photo published by Schultze is that of a more slender fish than that illustrated by Eigenmann and the specimen is without the dorsal fin spot. The aquarium specimen of *potaroensis* figured here has only a very pale dorsal spot and is more slender than the specimen of *potaroensis* illustrated by Eigenmann. However, as will be shown, specimens collected by Eigenmann in British Guiana agree well with the example illustrated here, and I think may justifiably be considered the same species.

The final species in this report, *Corydoras sychri*, is new, and is perhaps related to *potaroensis* or possibly to *longirostris* Hoedeman (1953). There is a possibility that *longirostris* is a synonym of *Corydoras ambiacus* Cope.

The aquarium specimens of *Corydoras acutus* and *potaroensis* were given to me by Mr. George Bald of San Francisco. The specimen of *Corydoras sychri* was received from Mr. Al Sychr of Hayward, California. I wish to take this opportunity to thank these persons for their generosity.

All proportions given below are in standard length unless otherwise indicated.

Corydoras habrosus, new species

Figures 1 and 2

MATERIAL.—Holotype, SU 52351, standard length 20.1 mm., collected February 25, 1950 by Agustin Fernandez-Yepez at the Río Salinas, a branch of Río Pao Viejo, El Baúl, State of Cojedes, Venezuela. Paratypes, SU 52350, four specimens, 14.2-16.9 mm. in standard length; same locality and data as for the holotype. For measurements see Table 1.

DESCRIPTION (Holotype first; data on paratypes in parentheses).—Body moderately elongate, greatest depth 3.0 (3.0-3.2). Least depth of caudal peduncle 7.2 (6.6-7.0). Dorsal fin origin nearer to snout tip than to caudal fin base. Distance between snout tip and dorsal fin origin 2.0 (2.0-2.2). Distance between snout tip and anus 1.9 (1.8-1.9). Origin of

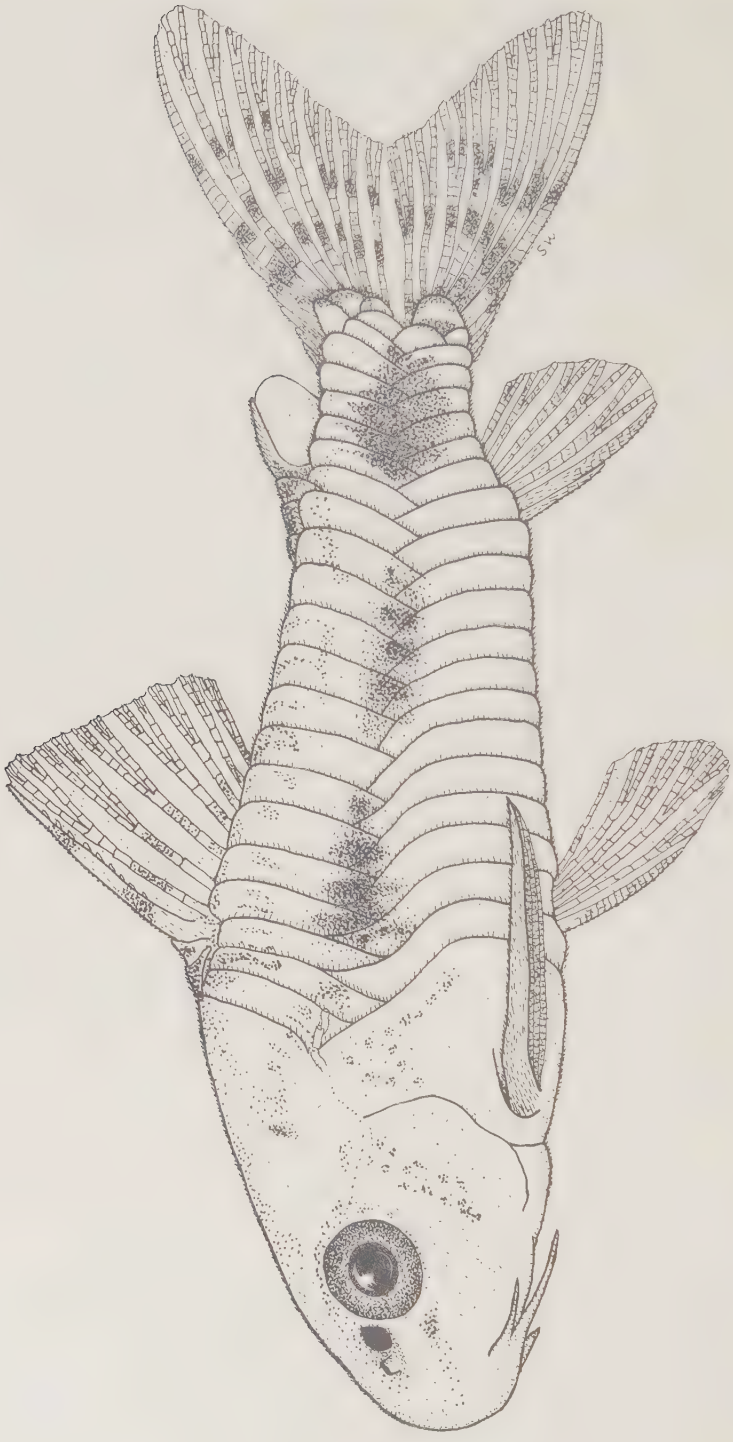

Fig. 1. *Corydoras habrosus*, holotype, SU 52351. Standard length 20

anal fin to snout tip 1.2 (1.2-1.3). Lateral scutes 22/19 (22/20 in one paratype). Abdomen naked. Azygous middorsal scutes 3 (3-4) before adipose fin and 1 before dorsal fin in all specimens. Pectoral fin base incompletely surrounded by the coracoid. Naked areas between coracoids 8.1 (7.4-8.8).

Head length 3.3 (3.2-3.5); its greatest width 1.2 (1.2-1.2) in its length. Least width of bony interorbital 2.3 (2.0-2.1) in head length. Snout rounded from dorsal view; its length 2.4 (2.3-2.4) in head length. Dorsal profile of snout continuously convex. Inferior rictal barbel reaching to a point almost directly below posterior margin of eye. Greatest diameter of bony orbit 1.2 (1.1-1.3) in head length. Greatest width of suborbital 2.6 (2.5-3.2 in orbit).

Dorsal fin I,7 in all specimens, the last fin ray split to its base (not split all the way to the base in the holotype). In all specimens, appressed dorsal fin spine and first soft ray not reaching adipose fin spine, which is 1.1 (1.3-1.5) in orbit. Anal fin ii,5 in all specimens, last ray not split to its base. Pectoral fin I,7 and pelvic fin i,5 in all specimens. Caudal fin with principal rays 7/7. Pectoral fin spine with spinules as shown in Fig. 2. Some of the paratypes had as many as 14 small spinules along the posterior border of the spine; none exceeded 17.

COLOR OF HOLOTYPE IN ALCOHOL.—The specimen is somewhat faded, especially the head. Basic body color a pale yellowish tan. Three dark midside blotches, the first below the dorsal fin, the second starting at the level

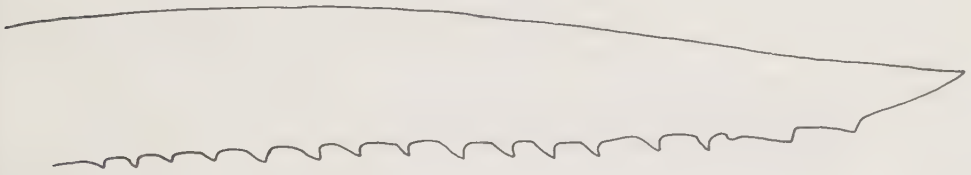

Fig. 2. *Corydoras habrosus*. Ventral view of left pectoral fin spine.

of the 10th upper body scute and continuing to the 14th scute. The third and darkest blotch is on the caudal peduncle and begins at the level of the 17th upper body scute and ends at the 22nd. The three azygous scutes before the adipose fin have dark upper surfaces. There are scattered dark markings on the superior portions of the upper scutes in the pattern shown in Fig. 1. The lower scutes are without dark markings except for the upper portions of those scutes associated with the three dark blotches.

The anterior base of the adipose fin spine has a scattering of melanophores; the adipose fin membrane is without dark markings. The dorsal fin is colorless except for two rows (the upper one very faded) of spots shown in Fig. 1. The upper row in this specimen is represented by a dark mark on the upper part of the dorsal fin spine. The caudal fin has four dark bands on the upper and three on the lower lobe. The pelvic, anal and pectoral fins are hyaline. The head is more faded than the body and shows only a few dark markings on the upper part of the coracoids, the operculum, the anterior portion of the suborbital bone, and above the eye. These are as placed in Fig. 1.

DISCUSSION.—This new species is most closely related to *Corydoras cochui* Myers and Weitzman (1954). Both seem to be pygmy species. A paratype of *habrosus*, 15.5 mm. in standard length, proved to be a female with eggs. Mr. Franz Weibezahn informs me that specimens larger than those reported here

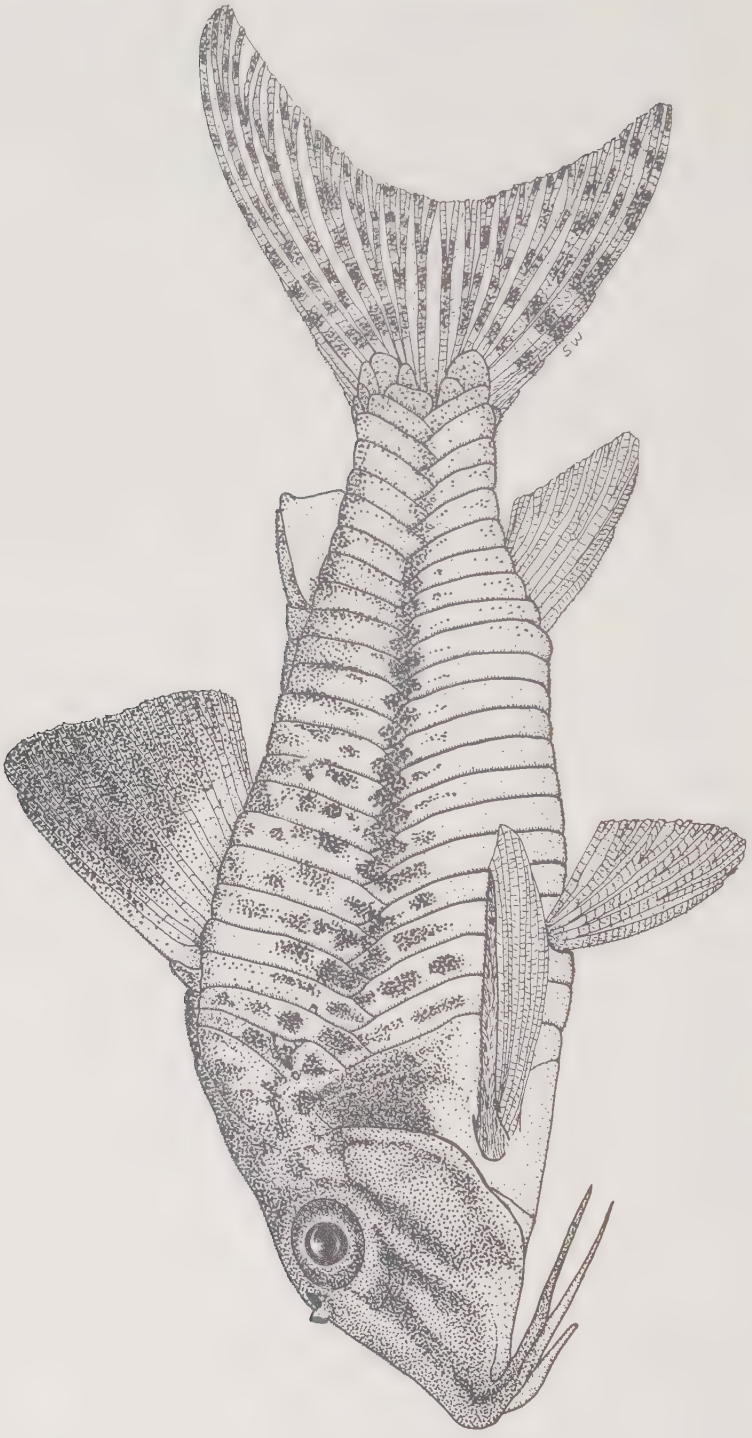

Fig. 3. *Corydoras acutus* Cope, SU 51304. Standard length 45.1 mm.

have not been seen. Weitzman (1956) noted that *cochui* was definitely a pygmy species. Both species have a similar color pattern: moderately barred caudal fin, midside black blotches, a two-barred dorsal fin, and probably an essentially similar color pattern on the head. However, *cochui* has a more slender body than *habrosus*, one more blotch on the side and a larger, differently shaped nostril (although this may be due to poorer preservation in *habrosus*). *Corydoras habrosus* has no spot at the pelvic fin base and the pectoral fins are apparently not barred. Also the upper rictal barbel of *cochui* equals the length of the lower, whereas it is much shorter than the lower in *habrosus*. Both species have two to three well-developed lateral-line pores above the coracoid. However, these are also present in several other species of *Corydoras*.

The name *habrosus* is from the Greek *habros*, meaning pretty, delicate or dainty.

Corydoras acutus Cope

Figures 3 and 4

Corydoras acutus Cope, 1872, p. 281 (original description; type locality: Río Ampiyacu; type lost).—Gosline, 1940, p. 16 (description, Río Ampiyacu); 1945, p. 74 (listed; distribution).—Weitzman, 1958, p. 251 (color photograph, aquarium description).

Corydoras agassizi (*non* Steindachner) Innes, 1935, p. 224 (photograph; aquarium description).

Corydoras stenocephalus Eigenmann and Allen, 1942, p. 177, pl. 12, fig. 2 (original description; type locality: Yarinacocha, Peru; type in California Academy of Sciences).

MATERIAL.—One specimen, SU 51304, standard length 45.1 mm., an aquarium specimen without certain locality but collected in 1956 or 1957 by the Perez Brothers, Inc., a firm which at that time was importing aquarium fishes from the Peruvian Amazon. For measurements see Table 1.

DESCRIPTION.—Body fairly deep, greatest depth 2.6. Least depth of caudal peduncle 7.2. Body width 4.0. Dorsal fin origin much nearer to snout tip than to caudal base. Distance between snout tip and dorsal fin origin 1.9. Distance between snout tip and anus 1.9. Origin of anal fin to snout tip 1.3. Lateral scutes 23/21. Abdomen without plates but covered with small bony spinules. Middorsal scutes 3 before adipose fin and 1 before dorsal fin. Pectoral fin base incompletely surrounded by coracoid. Area between coracoids 11.3.

Head length 2.9; its greatest width 1.5 in its length. Least width of bony interorbital 3.1 in head length. Snout acute in dorsal view; its length 1.6 in head length. Dorsal profile of snout distinctly concave. Both rictal barbels reaching a point just posterior to a level with the posterior border of the eye. Greatest diameter of the bony orbit 2.5 in snout and 4.1 in head length. Greatest width of the suborbital 1.5 in orbit.

Dorsal fin I,7, the last fin ray split almost to its base. In all specimens appressed dorsal fin spine and first soft ray not reaching adipose fin spine, which is longer than the orbit, 0.8 in orbit. Anal fin ii,5, last ray split to its base. Pectoral fin I,11, pelvic fin i,5. Caudal fin with principal rays 7/7. The pectoral fin spine (Fig. 4) has 20 large, strongly recurved spinules along its posterior border.

COLOR.—Ground color in alcohol pale yellow white. Body without large blotches but with a narrow, zigzag, midside, dark stripe that anteriorly is broken slightly and indistinguishably from broken vertical bars, one bar for each dorsal and ventral scute. These bars continue posteriorly as shown in Fig. 3. Other areas of body have pale tan upper scutes, the lower

ones almost white. In life (description from a Kodachrome) the vertical bars on the upper scutes are broken into three longitudinal series, especially anteriorly. There are bluish green reflections around the midlateral stripe and lighter colored but brighter greenish blue reflections on the ventral scute series. The latter color also occurs rather intensely on that portion of the coracoid above the pectoral fin and on the operculum. In these two places the color appears darker due probably to the underlying black pigment. In alcohol and in life there are two dark markings on the ventral surface of the adipose fin spine. The posterior upper border of the adipose membrane is dark. This dark area is more extensive in life. The caudal fin is hyaline except for about 10 or 11 black vertical bars on the upper lobe and five or six bars on the lower lobe. The distal two thirds of the spine and first five dorsal fin rays and membrane are black, especially so in life. The snout and head are marked as shown in Fig. 3. In life there are some bluish reflections in the dark quadrangular area below the eye. Pectoral and pelvic fins are hyaline, and the anal fin is hyaline except for a little dark pigment on the central areas of the first through third branched fin rays. This does not appear in the preserved specimen. The upper rictal barbel is dark, the lower white, in life and in the preserved specimen.

DISCUSSION.—The specimen described here agrees very closely with specimens described by Gosline (1940), but it differs from them notably in the

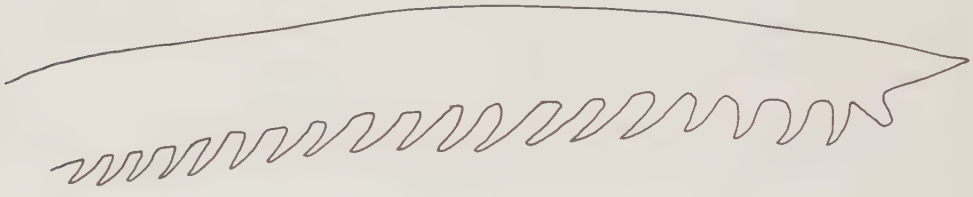

Fig. 4. *Corydoras acutus* Cope. Ventral view of left pectoral fin spine.

greater extent of the dark blotch on the dorsal fin. However, pigment is apt to fade, especially in specimens not preserved under ideal conditions. It may also be true that the extent of the dark blotch is variable. Neither the specimen at hand nor the specimens examined by Gosline agree completely with Cope's description. Cope (1872) stated that no azygous shields were present. Perhaps they were overlooked or torn away. Cope reported only four caudal bars (up to 11 in the specimen illustrated, and in Gosline's specimens) but he stated his specimen was faded. However, Cope describes the large dorsal fin spot and the blue reflections on the operculum and shoulder girdle; these were well shown in life by the specimen illustrated here. The specimen of *acutus* described as *stenocephalus* by Eigenmann and Allen (1942) is faded. It lacks the caudal bars and the dorsal fin spot. The color on the body is also faded. The illustration of Eigenmann and Allen is that of the faded holotype.

Corydoras potaroensis Myers
Figures 5 and 6

Corydoras punctatus (*non* Bloch) Eigenmann, 1912, p. 220 (in part), pl. 24, fig. 3 (Erukin and Potaro Landing, British Guiana).

Corydoras potaroensis Myers, 1927, p. 126 (original description; type locality: creek below Potaro Landing, British Guiana; type in the Museum of Comparative Zoology, Harvard).—Gosline, 1940, p. 23 (description, Potaro Landing, British Guiana); 1945, p. 76 (listed distribution).

Corydoras griseus Holly, 1940, p. 110 (original description; type locality: small watercourse in the region of the Amazon River; types in the Munchner Tierpark); 1949, p. 863 (aquarium description; figure).

Corydoras griseus de weyeri Meinken, 1957, p. 5 (original description; type locality: British Guiana; types in the private collection of Herr Meinken).—Holly, 1958 or 1959, p. 1124 (aquarium description; figure).

MATERIAL.—Two specimens, SU 51305, standard length 37.0-41.2 mm., aquarium specimens without locality. Two specimens, SU 21974, standard length 31.2-35.3 mm., collected October 1908 by Carl H. Eigenmann at Potaro Landing, the lower part of the Potaro River, British Guiana; these are much more faded than the more recently collected aquarium specimens. For measurements see Table 1.

DESCRIPTION (Specimens numbered SU 21974 are placed in parentheses).—Body fairly elongate, greatest depth 2.8 (2.8-2.9). Least depth of caudal peduncle 7.7-7.8 (7.8-8.0). Dorsal fin origin nearer to snout tip than to caudal fin base. Distance between snout tip and dorsal fin origin 2.0 (2.0-2.1). Distance between snout tip and anus 1.9-2.0 (1.9). Origin of anal fin to snout tip 1.2 (1.2-1.3). Lateral scutes 24/21 in all specimens. Abdomen naked. Azygous middorsal scutes 3 (4) before adipose fin and 1 before dorsal fin in all specimens. Pectoral fin base incompletely surrounded by coracoid. Naked area between coracoid bones 8.4-10.3 (7.7-10.0).

Head length 3.2 (3.1-3.2); its greatest width 1.2-1.3 (1.3-1.4) in its length. Least width of bony interorbital 2.7-2.8 (2.7-2.8) in head length. Snout moderately rounded from dorsal view, its length 1.9-2.0 (2.0) in head length. Dorsal profile of snout continuously and strongly convex. Both rictal barbels of one side about equal in length and reaching a level just posterior to the eye. Greatest diameter of bony orbit 1.6-1.8 (1.8) in snout, 3.2-3.5 (3.4-3.5) in head length. Greatest width of suborbital 1.7-2.1 (1.8-2.3) in orbit.

Dorsal fin I,7 in all specimens, the last fin ray split to its base. In all specimens appressed dorsal fin spine and first soft ray not reaching adipose fin spine, which is 1.4-1.5 (1.3) in orbit. Anal fin ii,5, last ray split to its base. Pectoral fin I,9-I,10 (I,9). Pelvic fin rays i,5, in all specimens. Caudal fin with principal rays 7/7. The pectoral fin spine (Fig. 6), has as many as 34 small spinules. The specimens from British Guiana have only 24, more regularly arranged spinules, but these are smaller specimens and can be expected to have fewer spinules. The specimen illustrated looks as though it had been injured, for all the other specimens had small, regular postero-laterally directed spinules.

COLOR.—The specimen figured (Fig. 5) has the following color in alcohol: sides without black spots, posterior edge of each dorsal scute edged in black, darker towards the back. All inferior scutes edged in black except anteriorly on the belly and above the pelvic fin. Dark markings on head and nape as shown in Fig. 5. The snout is dusky, the cheeks below the eye and the area around the coracoids quite clear. The dark mask over the eye is well developed. Other than the posterior dark edges of the scutes, the body has a scattering of melanophores over the scutes in a pattern as shown in Fig. 5. The pectoral, pelvic and anal fins are hyaline, the caudal fin mostly so, but a few (about 4) very narrow dusky vertical bands at its base. The dorsal fin is without dark markings except for a thin scattering of melanophores at the middle and especially the base of the dorsal fin. This

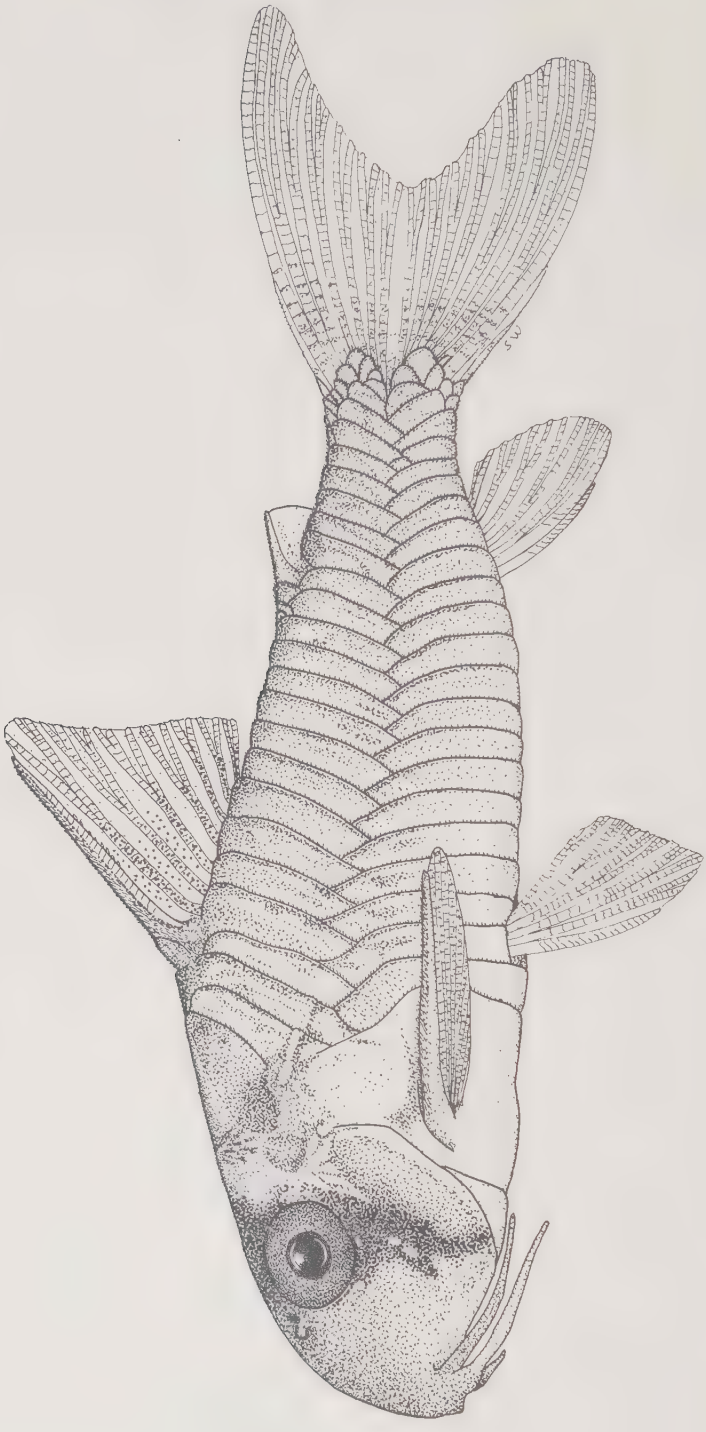

Fig. 5. *Corydoras potaroensis* Myers, SU 51305. Aquarium specimen.

area in the specimens from British Guiana is an intense dark blotch. The general body color is a light tan, paler around the belly and ventral region of the mouth. The specimens of *potaroensis* from British Guiana have the same general color pattern but they are faded; the caudal fin shows no evidence of the dusky, narrow vertical bars, but the spot at the proximal region of the dorsal fin is quite dark or almost black in these otherwise faded specimens.

In life the aquarium specimen of *potaroensis* figured was a moderate tan color, looking much as it does in alcohol. The color photo shows two bluish reflections, one on the operculum and one on the coracoid above the pectoral fin. The melanophore pattern is much as it is in alcohol.

DISCUSSION.—I identify *Corydoras griseus* Holly with *potaroensis*, but only tentatively. The photo published by Schultze (1939) is poor and heavily retouched. The sketch published by Holly (1949) is fair and definitely suggests the specimen of *potaroensis* figured here. The description of Holly (1940 and 1949) does not quite agree with the present description in a few proportions. The head of *griseus* is reported to be 3.48 times in the body length rather than 3.1 to 3.2 as in the specimens at hand. The snout-in-head proportion of Holly's specimen is recorded as 2.18 while it is 1.9-2.0 in the specimens recorded here. The interorbital-in-head proportion of Holly's specimen is 2.97 while the specimens recorded here show

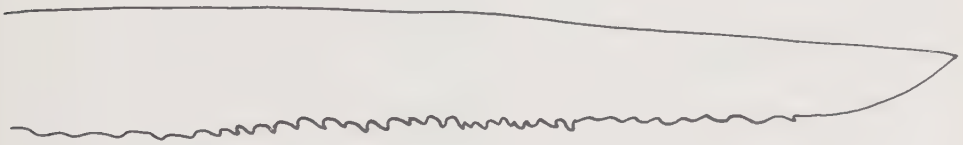

Fig. 6. *Corydoras potaroensis* Myers. Ventral view of left pectoral fin spine.

2.7 to 2.8. Perhaps the greatest difference is in the eye size, 2.72 for Holly's specimen versus 3.2 to 3.5. Holly's specimen was larger (47.7 mm.) than any of the specimens at hand and could be expected to have slight differences in proportions. However, the larger eye in Holly's specimen does seem strange for eyes are usually proportionately smaller in larger specimens of one species. Perhaps the differences recorded here are due to differences in techniques of measurement for I measure the greatest diameter of the bony orbit; Holly probably measured the diameter of the eye itself. The lowest figure I could obtain by measuring the eye of the specimens at hand was 2.9. The color description of *griseus* does not contradict that of *potaroensis* as described here, but it is probably not complete, for the rather faint and narrow caudal bars are not mentioned nor is the dark edging of the body plates.

Corydoras griseus is reported from water courses in the neighborhood of the Amazon River, a long distance from the localities recorded for *potaroensis*. This locality is rather indefinite and it could be wrong. Localities reported by dealers and importers of aquarium fishes are sometimes deliberately made indefinite or even misstated. I prefer to consider this locality as questionable.

Corydoras griseus deweyeri Meinken (1957) appears related to *potaroensis* but has a somewhat different color pattern. It has a fairly dark midside stripe and a darker, more extensive mask over the head, cheeks and eyes. Meinken considered *deweyeri* to be a subspecies of *griseus*.

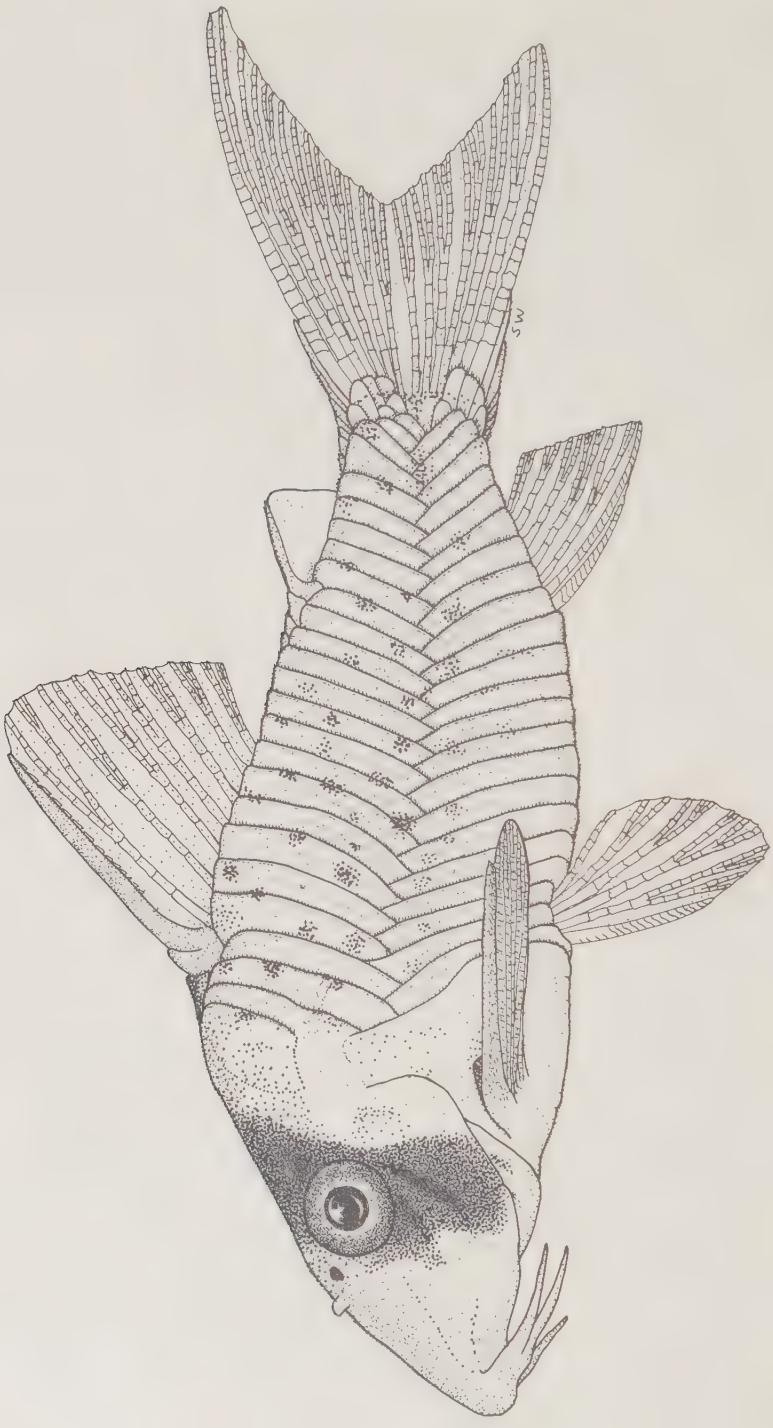

Fig. 7. *Corydoras sychri*, holotype, SU 51295. Standard length 36.5 mm. Aquarium specimen.

Myers (1927) noted that some specimens of *potaroensis* were more compressed laterally than others, and it seems quite likely that these represent males. Eigenmann's (1912) figure of *potaroensis* undoubtedly is a photo of a female. Males of some species of *Corydoras* are markedly more slender than the females. This is especially true of *paleatus* and is presumably true of *potaroensis*.

It seems quite probable then that there is some geographical variation in the color pattern of *Corydoras potaroensis*. Specimens from the Potaro River, British Guiana, have a dark dorsal fin spot; specimens reported here from other (unknown) localities are without the spot. One of these without the spot has apparently received the name *griseus*, and this name probably applies to the form of *potaroensis* figured here. It may be from the Amazon basin. The other, *deweyeri*, was imported from British Guiana in 1956 and is, like *griseus*, possibly a geographical race or subspecies of *potaroensis*. Only extensive collections of *Corydoras potaroensis* throughout its geographical range will indicate the true nature of the geographical variation in the species.

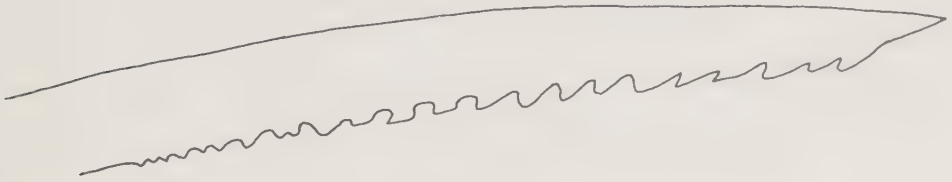

Fig. 8. *Corydoras sychri*. Ventral view of left pectoral fin spine.

Corydoras sychri, new species
Figures 7 and 8

MATERIAL.—Holotype, SU 51295, standard length 36.5 mm., an aquarium specimen without locality. Collected in 1956 or 1957 in tropical South America. For measurements see Table 1.

DESCRIPTION.—Body moderately elongate, fairly deep, greatest depth 2.6. Least depth of caudal peduncle 7.0. Dorsal fin nearer to snout tip than to caudal fin base. Distance between snout tip and dorsal fin origin 2.0. Distance between snout tip and anus 1.8. Origin of anal fin to snout tip 1.2. Lateral scutes 25/23. Abdomen without bony plates, but with small, scattered, conical denticles. Azygous middorsal scutes 3 before adipose fin, and 1 before dorsal fin. Pectoral fin base incompletely surrounded by coracoid. Area between coracoids 9.1.

Head length 2.9; its greatest width 1.6 in its length. Least width of bony interorbital 2.3 in head length. Snout fairly acute in dorsal aspect, its length 1.7 in head length. Dorsal profile of snout straight or very slightly concave, area above eyes slightly concave. Both rictal barbels reaching a point below the anterior border of the iris. Greatest diameter of bony orbit 2.2 in snout, 3.8 in head length. Greatest width of suborbital 1.9 in orbit.

Dorsal fin I,7, the last fin ray split to its base. Appressed dorsal fin spine and first soft fin ray not reaching adipose fin spine, which is 1.0 in orbit. Anal fin has fin rays ii,5, last ray split to its base. Pectoral fin I,8, pelvic fin i,5. Caudal fin with principal rays 7/7. The

Measurements	habrosus					acutus	potaroensis				sychri
	holotype 52351	paratypes 52350				51304	51305		21974		type 51295
Standard length	20.1	14.2	15.5	15.8	16.9	45.1	41.2	37.0	35.3	31.2	36.5
Head length	6.1	4.5	4.8	4.6	4.8	15.7	13.4	11.7	11.3	9.8	12.6
Snout length	2.6	1.9	2.0	2.0	2.0	9.6	6.9	5.8	5.8	4.9	7.3
Least width of bony interorbital	2.7	2.2	2.3	2.2	2.3	5.0	4.9	4.2	4.1	3.6	5.4
Greatest diameter of bony orbit	2.1	1.5	1.7	1.6	1.9	3.8	3.8	3.6	3.3	2.8	3.3
Greatest width of sub-orbital	0.8	0.6	0.6	0.6	0.6	2.6	2.3	1.7	1.8	1.2	1.7
Length of fontanel	1.3	1.8	1.4	1.2	1.4	6.4	4.0	3.6	3.1	3.0	4.8
Length of predorsal scale	1.1	0.6	0.8	0.7	0.8	3.2	2.4	1.8	2.0	1.6	3.0
Greatest width of head	5.2	3.7	3.9	3.8	3.9	10.7	10.2	9.5	8.8	7.0	8.1
Snout tip to dorsal fin origin	10.1	7.2	7.3	7.4	7.8	23.3	20.9	18.4	17.4	15.0	18.7
Snout tip to adipose fin origin	17.9	11.9	13.1	13.1	13.9	37.2	34.4	30.5	29.1	25.4	30.1
Snout tip to anal fin origin	16.9	11.7	12.3	12.4	13.5	35.5	34.2	30.4	28.1	25.2	29.4
Snout tip to anterior edge of anus	10.6	8.1	8.6	8.6	9.0	23.9	21.1	19.2	18.6	16.0	19.8
Greatest body depth	6.6	4.6	5.1	5.0	5.5	17.1	14.6	13.0	12.5	10.8	14.1
Least depth of caudal peduncle	2.8	2.1	2.2	2.4	2.5	6.4	5.3	4.8	4.4	4.0	5.2
Distance between coracoids	2.5	2.0	1.9	1.8	2.1	4.0	4.0	4.4	4.6	3.0	4.0
Length of dorsal spine	4.9	?	3.8	3.4	3.9	10.6	11.2	10.5	9.8	8.7	10.3
Length of pectoral spine	6.0	4.3	4.5	4.4	5.1	12.2	12.6	?	10.5	10.0	9.9
Length of adipose spine	1.8	1.2	1.1	1.2	1.5	4.8	2.8	2.4	2.5	2.2	3.4

Table 1. Genus *Corydoras*. Specimens of four species measured in millimeters. Numbers below scientific names refer to Natural History Museum of Stanford University Register Numbers. (?=Spine damaged.)

pectoral fin spine (Fig. 8), has about 23 moderately sized spinules pointing in a postero-medial direction.

COLOR OF HOLOTYPE.—Ground color in alcohol a pale tannish white. Fish without dark markings except as follows: snout and head anterior to eyes dusky. Cheek, anterior to the dark vertical band which extends through the eyes, is pale, almost white. Area of head posterior to the dark vertical band whitish except for a dusky area over the nape. Coracoids whitish tan. All scutes of body with a fine row of melanophores along their posterior borders. Dark spots scattered over the body scutes as shown in Fig. 7. Back slightly more dusky than the sides and belly. All fins are without markings except for a small spot at the anterior base of the adipose fin.

In life this fish was very striking. The body was a very pale tan, almost white with bluish white reflections. It was slightly duskier over the top of the snout and along the midline of the back. The vertical band or mask over the eyes was almost jet black and the contrast between the mask and the rest of the body was outstanding. This contrast largely remains in the specimen in alcohol. The black spots over the sides were also quite prominent in life. The fins were hyaline.

DISCUSSION.—The relationships of this new species to the known members of the genus *Corydoras* are not clear. In Gosline's key (1940), the specimen keys to *potaroensis*, but even brief examination indicates that the two are different, notably in the elongate snout and the greater number of lateral scutes of *sychri* (compare data recorded above). If one tries to key this fish in the "elongate snout" section of Gosline's key, it keys to *barbatus*, a fish bearing little resemblance to *sychri*. Of all the known species of *Corydoras*, *sychri* looks most like *Corydoras longirostris* Hoedeman (1953) (described as *Corydoras melanistius longirostris* by Hoedeman) but lacks the caudal bars, the black spot on the dorsal fin and dorsum and, in addition, has fewer body spots. *Corydoras sychri* has a dark mask over the eyes. A mask is present in *longirostris* but at least in the photograph it does not appear as intense as the mask of *sychri*. It seems quite evident from studying the photo published by Hoedeman (1953, p. 198; and 1954, p. 265) that *longirostris* and *sychri* are distinct; however, *longirostris* needs further examination to clarify some of its meristic characteristics. The possible relationship of *longirostris* to *Corydoras ambiacus* Cope should be studied.

This new species is named for Mr. Al Sychr of Hayward, California. Mr. Sychr (he pronounces it Sī´ker) is an aquarist with a special interest in members of the genus *Corydoras*. He has given many specimens to me for study.

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FIGURES AND DESCRIPTION OF A SOUTH AMERICAN CATFISH, CORYDORAS RETICULATUS FRASER-BRUNNER

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Although occasionally imported as an aquarium fish, *Corydoras reticulatus* is actually little known and the only specimen to receive a fairly adequate description is the neotype, collected at Monte Alegre on the Amazon River, Brazil, during 1926 by Dr. Carl Ternetz. Fraser-Brunner (1938) originally described *Corydoras reticulatus* from aquarium specimens without locality. This description and its accompanying two sketches, apparently from live specimens, was not intended to be the original description of a new species. Nevertheless, since it contains a new name, a statement that the fish is a new species, a diagnosis and a description, it must be considered as the original description. The diagnosis and description are based solely on color pattern. In 1947 Fraser-Brunner described and figured the specimen collected by Dr. Ternetz as a new species, *Corydoras reticulatus*, and included copies of the two sketches he had published in 1938. One of these sketches he believed to represent a male, the other a female. Because the specimen designated as the holotype by Fraser-Brunner (1947) was not utilized in the original description of 1938, it cannot be considered a holotype. According to Fraser-Brunner (1947) the specimens used for the original description are not now in existence. Therefore no type material of this species exists. Thus it would seem proper to designate as a neotype the specimen used by Fraser-Brunner (1947).

The purpose of the present paper is to illustrate and describe this species as part of a series of papers on all available members of the genus *Corydoras*.

The specimens used in this report are aquarium specimens with a rather indefinite locality but nevertheless one that agrees in a general way with that of the neotype. They are the only examples (other than the neotype) from which meristic data have been recorded. Perhaps there is some compensation in the fact that the use of aquarium specimens (with indefinite and perhaps unreliable locality data) has allowed the presentation of life-color descriptions. Figures 1 and 2, of SU 52584 and SU 52585, respectively, were made before the lot of fishes designated by SU 57684 were received. As will be shown below, there are indications that each group of fishes came from a different locality, and represents samples of different local populations. All the specimens utilized here were donated by Mr. Al Sychr of Hayward, California.

All proportions are in standard length unless otherwise stated.

Corydoras reticulatus Fraser-Brunner

Figures 1, 2 and 3

Corydoras reticulatus Fraser-Brunner, 1938, p. 208 (original description; no locality; no type specimens); 1947, p. 245 (Monte Alegre, State of Amazonas, Brazil; neotype in British Museum [Natural History]). —Axelrod and Schultz, 1955, p. 367 (description from life and reproduction of figure of neotype). —McInerny and Gerard, 1958, p. 340 (description from life and photograph).

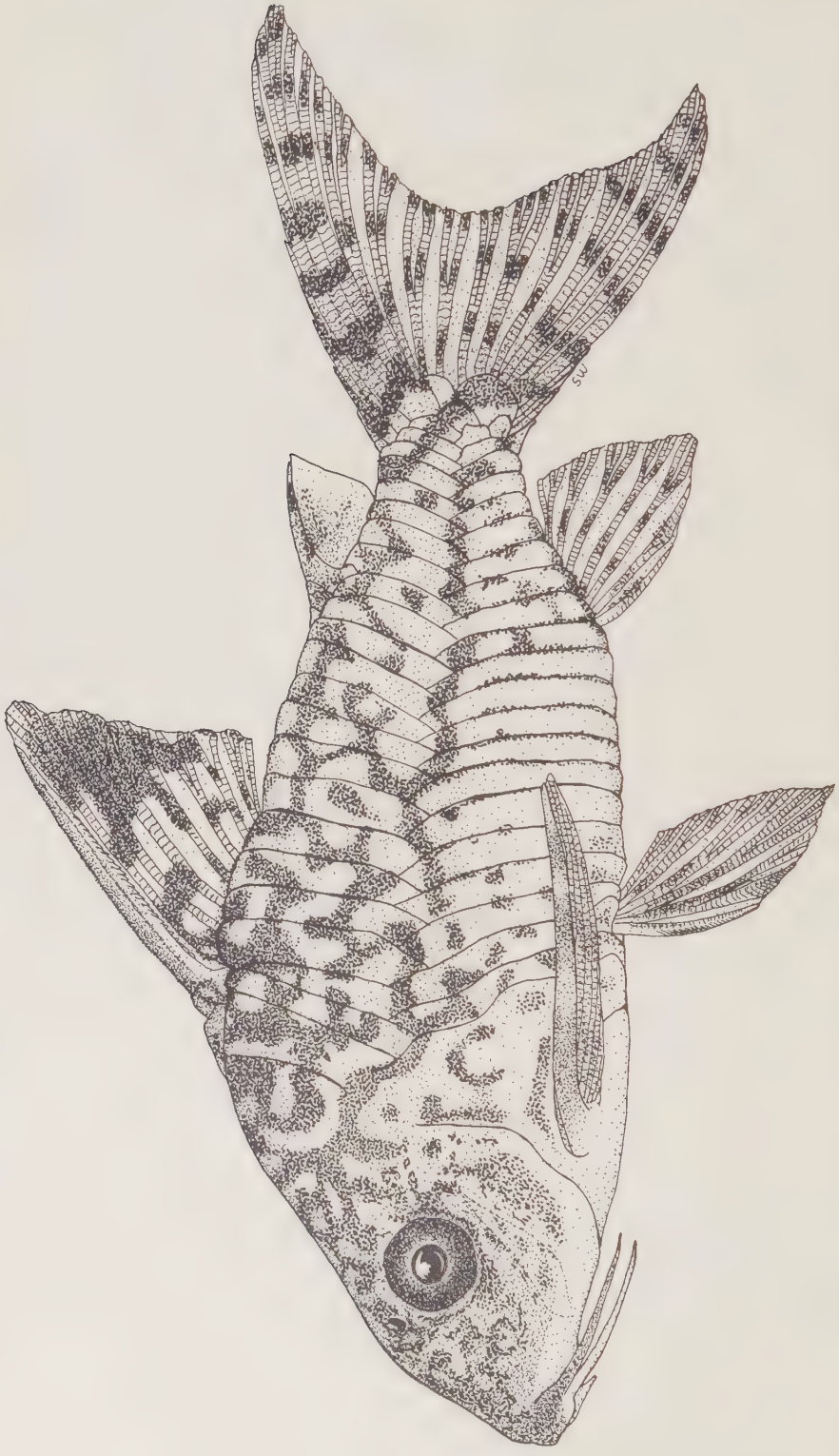

Fig. 1. A male of *Corydoras reticulatus* Fraser-Brunner, SU 52584. Standard length 42.7 mm.

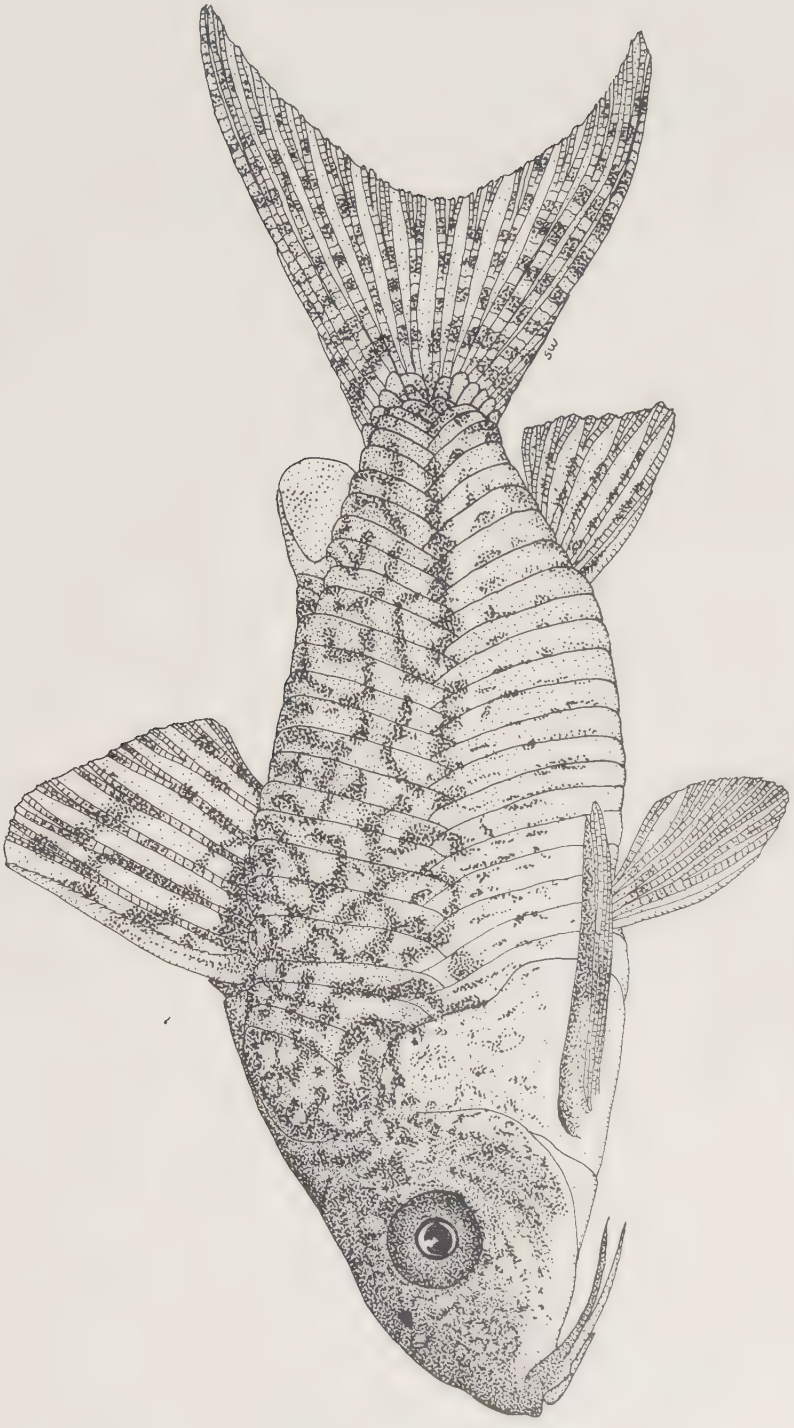

Fig. 2. A female of *Corydoras reticulatus* Fraser-Brunner, SU 52585. Standard length 37.3 mm.

Corydoras punctatus reticulatus Hoedeman, 1954, p. 263 (description from life; photograph erroneously labelled "*Corydoras acutus*?").

MATERIAL.—One specimen, a male, SU 52854, standard length 42.7 mm. One specimen a female, SU 52585, standard length 37.3 mm. Five specimens, SU 57684, standard length 40.9-47.4 mm. All specimens, said to be from the "Lower Amazon", were collected by Paramount Aquarium during 1958 to 1959. For measurements see Table 1.

DESCRIPTION.—(Specimen numbered SU 52584 recorded first, specimen numbered SU 52585 placed in parentheses and specimens numbered SU 57684 placed in brackets). Body moderately elongate, greatest depth 2.3 (2.4) [2.4-2.6]. Least depth of caudal peduncle 7.1 (7.2) [7.2-7.9]. Dorsal fin origin nearer to snout tip than to caudal fin base. Distance between snout tip and dorsal fin origin 1.9 (2.0) [1.8-2.0]. Distance between snout tip and anus 1.8 (1.9) [1.8-1.9]. Origin of anal fin to snout tip 1.2 (1.2) [1.2-1.3]. Lateral scutes 23/20 (25/22) [23/20, 23/21, 24/21, 24/21, 24/21]. Abdomen naked. Azygous middorsal scutes 3 (3) [2, 2, 2, 3, 3] before adipose fin; 1 scute before dorsal fin in all specimens. Pectoral fin base incompletely surrounded by coracoid. Naked area between coracoid bones 19.1 (11.3) [10.5-14.1].

Head length 2.9 (3.2) [2.9-3.2]; its greatest width 1.4 (1.3) [1.4-1.5] in its length. Least width of bony interorbital 1.9 (1.8) [1.9-2.1] in head length. Snout moderately acute from dorsal view, its length 1.9 (1.7) [1.8-1.9] in head length. Dorsal profile of snout slightly concave to slightly convex. Both rictal barbels of one side about equal in length and reaching a level just posterior to the pupil of the eye, but anterior to the posterior border of the eye. Greatest diameter of bony orbit 1.9 (1.9) [1.7-2.2] in snout, 3.6 (3.2) [3.3-3.9] in head length. Greatest width of suborbital 1.4 (1.9) [1.2-1.6] in orbit.

Measurement	SU 52584	SU 52585	SU 57684				
	♂	♀	♂	♂	♀	♀	♀
Standard length	42.7	37.5	42.8	40.9	47.4	46.5	43.3
Head length	15.2	11.7	14.9	13.5	15.6	15.5	13.8
Snout length	8.0	6.7	8.2	7.1	8.7	8.7	7.3
Least width of bony interorbital	8.1	6.4	7.0	6.6	7.7	8.0	7.0
Greatest diameter of bony orbit	4.2	3.6	4.2	3.7	4.0	4.1	4.2
Greatest width of suborbital	3.0	1.9	2.9	3.0	2.7	2.8	2.7
Length of fontanel	5.2	4.6	5.8	5.6	6.1	5.8	5.7
Length of predorsal scale	3.1	2.9	3.3	3.4	3.8	3.6	3.3
Greatest width of head	10.9	8.7	9.9	8.8	10.8	10.9	9.7
Snout tip to dorsal fin origin	22.9	18.9	23.5	21.6	24.2	24.3	22.5
Snout tip to adipose fin origin	37.7	31.5	37.4	34.1	40.1	40.0	37.2
Snout tip to anal fin origin	35.5	30.4	35.5	32.6	39.1	38.3	36.1
Snout tip to anterior edge of anus	23.4	20.1	23.5	21.7	25.1	25.0	23.7
Greatest body depth	18.4	15.3	17.5	15.6	18.6	18.6	16.8
Least depth of caudal peduncle	5.2	6.0	5.7	5.4	6.3	6.5	5.6
Distance between coracoids	2.3	3.3	3.8	2.9	4.5	4.2	3.7
Length of dorsal spine	13.5	10.2	12.2	11.3	12.4	11.8	10.0
Length of pectoral spine	14.0	11.1	14.1	12.4	14.5	12.7	12.4
Length of adipose spine	4.6	2.9	3.7	3.2	?	3.7	?

Table 1. *Corydoras reticulatus*. Measurements of specimens in millimeters. (?=Spine damaged.)

Dorsal fin I,7 in all specimens, the last fin ray split to its base. In all specimens appressed dorsal fin spine and first soft ray not reaching adipose fin spine which is 0.9 (1.2) [1.1-1.2] in orbit. Anal fin ii,5 (ii,6 in one female specimen of SU 57684), last ray split to its base. Pectoral fin I,9 (I,9) [I,9 in all specimens except three which had I,10 on the right side]. Pelvic fin rays i,5 in all specimens. Caudal fin with principal rays 7/7 in all specimens. Pectoral fin spine (Fig. 3) has 37 (28) [24-31] spinules along its posterior border.

COLOR.—The male specimen figured (Fig. 1) has the following color in alcohol: The general body color is a pale tan, darker over the dorsum of the body and head and almost white on the belly and ventral region of the mouth. The sides of the body and nape are marked with a rather large, irregular reticulum of dark markings. These are much better developed on the upper body scutes. However, in some other males (SU 57684) the reticulate markings are better developed on the lower body scutes than in the specimen illustrated. The reticulations are smaller and denser over the snout, around the eyes and on the top of the cranium. The posterior and anterior edges of the lower body scutes in front of the anal fin are black. The parts of the fins not marked with dark brown to black (see Fig. 1) are white. The caudal fin has about 6 rows of vertical bars. The distal black spot on the dorsal fin is evident only in the male specimen illustrated in

Fig. 3. *Corydoras reticulatus*, SU 52584. Dorsal view of left pectoral fin spine.

Fig. 1. All other specimens have dorsal fins marked similarly to that of the specimen illustrated in Fig. 2. The pectoral fin is mottled with rather irregular spots mostly confined to the fin rays. There are also dark markings on the fin rays of the pelvic and anal fins. These are arranged more or less in three rows on the anal fin.

In life the basic body color was a greenish tan. This color was darker on the back and top of the head. The belly, ventral gill region, lower rictal barbel and ventral mouth parts were almost white. The sides of the body reflected a slightly irridescent steel blue color. The placement and appearance of this color depended upon the angle of the incident light and the position of the viewer's eye. The large dark spot on the operculum in life was a dark greenish blue. The upper region of the operculum reflected a brassy color.

The female specimen figured (Fig. 2) has the following color in alcohol: The general body color is a pale tan, darker over the dorsum of the body and head and yellow white on the belly and ventral region of the mouth. The sides of the body and nape have irregular dark reticulations. These are less coarse than in the male, and there are more of them in the female than in the male. As in the male these markings are smaller and denser over the snout, around the eyes and on top of the cranium. The female has, at least in the specimen illustrated, a denser fine scattering of melanophores over the surface of the body. This is not true in the other females

examined. The fins are colored like those of the male except there is no dark dorsal fin spot and there are more caudal fin bars, about 11. These are not consistent sexual differences, however, for the other females examined did not have a greatly increased number of caudal fin bars.

In life the color was like that of the male, the only essential difference being the smaller reticulations.

SEXUAL DIMORPHISM.—Fraser-Brunner (1947, p. 246) published copies of two sketches of *Corydoras reticulatus* that he made from life in 1938. He presumed these two specimens to be a pair. In short, he noted that the reticulate pattern in the female was more complex. He was unable to confirm this observation because he no longer had the original specimens. The specimens at hand confirm Fraser-Brunner's observation. Gross dissection of the right side and histological examination of the gonads confirm the determination of sex in the specimens examined for the present report.

The following external sexual characters may be listed for *Corydoras reticulatus*: The male has larger and coarser reticulations than the female. The male also has a longer genital papilla. The genital papilla of the female is often buried in the folds of the anus whereas in the male it remains as a distinct papilla at the posterior edge of the anus, often about 0.2 to 0.3 mm. in length. The male has a more pointed pelvic fin than the female.

Close comparison of the accompanying figures of *Corydoras reticulatus* presented here (Figs. 1 and 2) might lead one to assume that other features of sexual dimorphism are present in this species. The adipose, the dorsal and the pectoral fin spines differ in size in the two figures. These size differences may not be indicators of sex, for in the other males examined (SU 57684), the size of these spines approximated those of the illustrated female. However, it should be pointed out that the specimens recorded here probably came from three different localities, and each is represented by a different Stanford University number; they were obtained at three different times from three separate shipments of aquarium fishes. If, as I believe, they are from three localities, it is not unlikely that the character differences discussed in this paragraph represent geographical variation. Investigation of the possibility that males of some populations of *C. reticulatus* have longer fin spines than females will have to await adequate samples of local populations.

DISCUSSION.—The relationships of this species to other members of the genus *Corydoras* are obscure. Fraser-Brunner (1947) made no attempt either to differentiate his new catfish from other species or to remark about its relationships to any other species of *Corydoras*. However, in his earlier and briefer paper (1938) he compared *C. reticulatus* to *C. leopardus* Myers (at the present considered to be a synonym of *C. julii* Steindachner) and noted that it was perhaps close to this species but differed from it and all other known species of *Corydoras* in color pattern. Gosline (1940) did not include *C. reticulatus* in his key to the species of the genus *Corydoras*; he apparently had not seen Fraser-Brunner's paper. The specimens at hand do not satisfactorily fit the characters of any species included in Gosline's key. Nor do they agree closely with any species of *Corydoras* described subsequent to Gosline's paper. They most closely fit in Gosline's group of species with a barred caudal fin. They obviously differ from all these in the reticulate color pattern and in the presence of a band along the junction of rows of body scutes. In addition, character-by-character comparison of this species with any of the nine species in this group shows many additional differences.

The specimens of *Corydoras reticulatus* examined here have certain characters with a rather wide range of variation. For example, the lateral scute count is variable; this is due to differences in scute patterns on the posterior part of the caudal peduncle. Close examination of the data

recorded above will indicate other striking examples. There may be some geographical variation in certain aspects of color pattern (for example, dorsal fin spot), proportions and counts.

Hoedeman (1954, p. 263) placed *Corydoras reticulatus* and several other species (such as *C. julii* Steindachner and *C. funnelli* Fraser-Brunner) as subspecies of *Corydoras punctatus* (Bloch). He does not present any evidence for this action and the only reason for this step would seem to be that all these species have spots on the body and a barred caudal fin. Hoedeman believed many species of the genus *Corydoras* to be subspecies. It is not unlikely that he may prove correct, at least with respect to a certain few forms now usually considered to be species. However, after a careful examination of the existing descriptions of the species of *Corydoras*, I believe that the data available do not as yet warrant such action. Most of the generally recognized species seem quite distinct, and indeed, further examination of some of them indicates they are more distinct than was previously believed. It is my opinion that until adequate collections can be made from many exact localities throughout the ranges of the various species of *Corydoras*, and until convincing data can be assembled and studied, the solution of the problem of subspecies in the genus *Corydoras* should be postponed.

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FISHES OF THE STANFORD ANTARCTIC BIOLOGICAL RESEARCH PROGRAM, 1958–1959

By Hugh H. DeWitt and James C. Tyler

INTRODUCTION

This paper is a report on the fishes collected by various members of the Stanford University Antarctic Biological Research Program,[1] which began in 1958 and is still continuing. Doctor Donald E. Wohlschlag, Associate Professor of Biology and director of the project, collected fishes at McMurdo Sound in the Ross Sea, as did John H. Dearborn and Hugh H. DeWitt. DeWitt and Dearborn also collected while aboard the icebreaker U.S.S. "Glacier" in the Ross Sea. James C. Tyler collected while aboard the icebreaker U.S.S. "Edisto" in the Weddell Sea and off the west coast of the Palmer Peninsula. Several other Stanford biologists are presently at McMurdo International Geophysical Year (IGY) base and fish collecting is continuing.

Our presently catalogued collection consists of 262 specimens representing 16 species of nototheniiform fishes, two of which, a bathydraconid and a chaenichthyid, are new and are here described and figured. This total of 16 species is not a large part of the close to 70 species of fishes known to occur south of the Antarctic convergence, that is, in truly Antarctic waters. On the other hand we should probably feel fortunate to have taken as many species as we did, for our methods of capture were limited to hand lines, fish traps, and slowly towed small bottom trawls. Our bottom trawls in many cases brought up fine samples of invertebrates, but usually they were being towed from ships drifting in the ice or moving at speeds inadequate for the capture of significant numbers of fishes. Fish traps were very effective either near the surface or on the bottom, but the number of species that can be taken in this manner would seem to be limited, and this also applies to hand-line fishing. There is little doubt, however, that the number of new species that will be taken from the Antarctic will increase greatly as soon as extensive midwater and bottom trawling is done at adequate speeds in areas other than the shallow and relatively well-fished waters of McMurdo Sound and the west coast of the Palmer Peninsula. The invertebrates collected along with the fishes have either been sent to the U.S. National Museum, or are still at McMurdo Base where they are being worked upon by Stanford biologists.

The order of presentation of the fish families represented in this collection follows that in Norman's (1938) monograph on Antarctic fishes, which is now the standard work for that region. Since specimens of most Antarctic fishes are not numerous in the various museums of the world and most descriptions are still based on very limited material, we also briefly describe here each previously known species represented in our collection. By so doing, we hope to increase knowledge of the variation to be expected in the species under consideration, as well as to present in a consistent manner certain basic counts, proportional measurements, and descriptive features that have sometimes been neglected in previous descriptions.

[1]This continuing research program is supported by National Science Foundation grant G-6328.

SYSTEMATIC PART

Throughout this paper (unless otherwise stated) proportional measurements and counts are defined as follows: *Length of head* is taken from tip of upper jaw to end of opercular, which is the end of the opercular spine when such is present; *horizontal diameter of eye* is that of the eye itself, not the orbit; *snout* is from tip of upper jaw to anterior margin of eye; *depth of body* is that at level of pelvic fin base. *Principal caudal fin rays* are the number of branched rays plus two, the "plus two" representing one unbranched ray both dorsally and ventrally; *scales in a longitudinal series* are the number in an epaxial series from above the top of the pectoral fin base to the end of the caudal peduncle. These counts were so taken to make them comparable to those of Norman (1938). The figure in parenthesis which usually follows the range of variation of a count or proportional measurement is the mean value of that character. *Length* of the specimen unless otherwise specified is the *standard length* (SL), taken from the tip of the upper jaw to the end of the caudal peduncle.

A statement is made at the beginning of each description giving the number of specimens, their Stanford University Natural History Museum (SU) register numbers, the collecting stations at which the specimens were taken, the general locality of the stations, and the range of standard lengths of the specimens. The complete station data are listed at the end of this paper. The abbreviation Stn. is used for Station.

The holotypes of the two new species, as well as a series of specimens of the other species here reported, will be deposited in the United States National Museum when work in progress is completed.

Family NOTOTHENIIDAE

This family contains 31 Antarctic species, and thus almost half of the fishes known from south of the Antarctic convergence. Our collection has representatives of nine of these species.

We feel that the following descriptions are of particular interest in several respects. We have found a spine, even though soft and flexible, in the anal fin of *Trematomus loennbergi*. A hyoid arch skin fold bearing gill-raker-like tubercles has been observed in all of the species here reported. Neither of these structures has been reported heretofore in this family. The large series of specimens of *Trematomus bernacchii* will substantially increase our knowledge of the variation in this species.

Notothenia larseni Lönnberg

Notothenia larseni Lönnberg, 1905, pp. 31 and 46, pl. 1, fig. 3, and pl. 2, fig. 6.

Six specimens, 76.7-148.6 mm., were taken off the west coast of the Palmer Peninsula near Victor Hugo Island, five of the specimens, SU 53577, from Stn. ED-7, the other, SU 53576, from Stn. ED-6.

Length of head 26 to 28 (27) percent of SL. Horizontal diameter of eye 36 to 42 (38) percent of head length. Length of snout less than that of

eye, 23 to 26 (25) percent of head length. Bony interorbital narrow, 6 to 7 (7) percent of head length. Maxillary extending posteriorly somewhat past anterior margin of eye. Branchiostegal rays 6, the membranes broadly united to one another over the isthmus, as well as to the isthmus for about three-fourths of their length. Gill rakers slender, 15 to 16 (15) on the lower limb of the first arch; an elongate opening between the fourth gill arch and the pharyngeal wall. Pseudobranchiae well developed, with about 16 long filaments. On the inner surface of the cheek just lateral to, and following the curve of, the first gill arch there is a fold of skin bearing 6 or 7 anteriorly directed, tough, stubby papillae. Alizarin staining of a section of one such papillose fold indicates that no ossification is present in the fold itself or the papillae which it bears. Since the papillae of this fold lie mainly over the ceratohyal, and although one is over the edge of the epihyal closest to the ceratohyal, they may be considered to be weakly developed hyoid arch gill rakers. The olfactory organ has a cylindrical nasal tube equal in length to about half the bony interorbital width; it bears a single round opening at its distal end. Head everywhere covered with finely ctenoid scales, with the exception of the fleshy tissue over the upper jaw, the entire lower jaw and the branchiostegal region. Teeth short and conical, in a single row in each jaw laterally, but becoming irregularly bi- or triserial anteriorly, the anteriormost teeth slightly longer than those internal to them.

Depth of body 15 to 19 (17) percent of SL. Spiny dorsal fin with 5 spines in each specimen, the first spine about on a level with the top of the pectoral fin base. The soft dorsal fin originates close behind the end of the spiny dorsal fin, its rays 36 to 40 (39). Anal fin origin about at level of seventh ray of soft dorsal fin, its rays 35 to 37 (36). Caudal fin with 16 principal rays; its posterior edge slightly rounded; the length of the longer rays 14 to 18 (16) percent of SL. Pectoral fin rounded and extending to level of sixth or seventh anal fin ray, its length 18 to 20 (19) percent of SL; 22 to 24 (23) rays, most of which are branched. Pelvic fin with a spine and 5 rays in each specimen, reaching to about the level of the anus; the third and fourth rays longest, 19 to 23 (21) percent of SL. The pelvic fin is notable for the extensive branching of the rays, particularly of the second to fourth rays, in the distal half of their length. There are, for example, 20 distal end segments to the fourth ray of the pelvic fin of the largest specimen and this is typical, not unusual. The first and fifth rays are not as extensively branched, and the same is true of all of the pelvic fin rays of the smaller specimens.

Body everywhere covered with finely ctenoid scales, 51 to 60 (55) in a longitudinal series. Upper lateral line with 48 to 52 (50) tubular scales. Lower lateral line usually without any tubular scales, although occasionally one or two may be present on the caudal peduncle. Scales extending a short distance onto the caudal fin and onto the lateral surface of the pectoral fin and to a slight extent onto the medial surface of the pelvic fin.

Ground color of specimens pale tan, with head slightly darker and abdominal region quite pale. About 4 dark, broad, dorsoventral cross bars on body. Pectoral, pelvic, and caudal fins with dark speckling which increases in intensity distally. Anal fin pale. Spiny dorsal fin with a black blotch on the distal half of its membranes. Soft dorsal fin with dark, irregular, small blotches throughout its length.

Several of the specimens are females with well-developed ovaries in which the eggs are grossly visible.

Trematomus nicolai (Boulenger)

Notothenia nicolai Boulenger, 1902, p. 184, pl. 15.

Three specimens, SU 53565, one, 153.0 mm.; SU 53563, one, 141.5 mm.; SU 53564, one, 134.5 mm., taken in McMurdo Sound, the specimens respectively from Stns. MM-25-12, MM-19-4, and MM-25-1.

Length of head 31 to 32 percent of SL. Horizontal diameter of eye 31 to 33 percent of head length. Snout shorter than eye, 25 to 26 percent of head length. Bony interorbital narrow, 10 to 12 percent of head length. Maxillary extending posteriorly to level of anterior fourth or fifth of eye. Branchiostegal rays 6, the membranes broadly united to one another over the isthmus, and to the isthmus for about three-fourths of their length. Gill rakers short and slender, 15 to 17 on the lower limb of the first arch; an elongate opening between the fourth gill arch and the pharyngeal wall. Pseudobranchiae well developed, with 22 to 24 long filaments. Hyoid arch gill rakers 5 or 6. Olfactory organ with a cylindrical nasal tube with a single opening at its tip, the tube equal in length to about half the interorbital width. Opercular, preopercular and cheek well scaled, the rest of head scaleless. Scales on opercular larger than those on preopercular, the scales in both areas being cycloid or very delicately ctenoid. Teeth slender, conical and slightly curved, not placed in a wide villiform band but rather well separated from one another in an irregular manner, those closest to the edge of the jaw longer than those internal to them.

Depth of body 23 to 24 percent of SL. Spiny dorsal fin with 4 spines, first spine approximately above top of pectoral fin base. Soft dorsal fin beginning just behind end of spiny dorsal fin, rays 37 to 38. Anal fin origin approximately below origin of tenth ray of soft dorsal fin, its rays 32 to 33. Caudal fin rounded, its length 18 to 19 percent of SL, with 14 principal rays in two specimens and 16 in one. Procurrent caudal fin rays well developed, posteriormost both dorsally and ventrally somewhat more than half length of unbranched principal caudal fin ray following. Pectoral fin rounded, longer middle rays reaching origin of ninth anal fin ray, their length 24 to 27 percent of SL; 29 rays in each specimen, most of which are branched. Pelvic fin with a spine and 5 well-branched rays, third and fourth rays longest, reaching past anus to base of first anal ray.

Body everywhere covered with finely ctenoid scales, 58 to 65 in a longitudinal series. Upper lateral line with 40 to 43 tubular scales; lower lateral line with a variable number of tubular scales, 10 in two specimens and 17 in one. Scales extending a short distance onto the caudal and pectoral fins.

Ground color of specimens yellowish tan to dark tan. Upper part of head and anterior epaxial region of body with dark blotches over the otherwise finely speckled skin. All fins tending to be more densely speckled with dark distally. Body with 4 or 5 dark irregular cross bars dorso-ventrally. Abdominal and branchiostegal regions lighter than rest of body.

Trematomus borchgrevinki Boulenger

Trematomus borchgrevinki Boulenger, 1902, p. 178, pl. 12.

Eight specimens from McMurdo Sound and the Weddell Sea in the Duke Ernst Bay region at the following stations: ED-2: SU 53568, one, 129.8 mm.; ED-3: SU 53569, one, 166.8 mm.; ED-4: SU 53570, two, 106.5 and 119.2 mm.; ED-5: SU 53567, one, 118.7 mm.; MM-18-3: SU 53566, one, 83.2 mm.; MM-21-4: SU 53572, one, 197.0 mm.; and MM-22: SU 53571, one, 160.2 mm.

Length of head 27 to 29 (28) percent of SL. Horizontal diameter of eye 26 to 30 (28) percent of head length. Snout only slightly longer than eye 29 to 31 (30) percent of head length. Bony interorbital wide, 31 to 35 (33) percent of head length. Maxillary extending posteriorly to the

level of anterior fourth or third of eye. Nasal tube with single opening at its tip, short, in length equal to about one tenth the interorbital width. Teeth conical and strong, in a single row laterally in each jaw, but becoming irregularly biserial anteriorly, with the outermost anterior teeth enlarged. Branchiostegal rays 6, the membranes united to one another over the isthmus, and to the isthmus for their entire length. Gill rakers relatively short, 16 to 19 (17) on the lower limb of first arch. Hyoid arch skin fold with 6 to 9 gill rakers. Pseudobranchiae with 15 to 20 long filaments. A long opening between the fourth gill arch and the pharyngeal wall. Head everywhere scaleless, except for patches of cycloid or very finely ctenoid scales on the upper half of opercular and preopercular.

Depth of body 19 to 23 (21) percent of SL. Origin of spiny dorsal somewhat anterior to level of top of pectoral fin base, its spines 5 in three specimens, 6 in the five others. Soft dorsal fin beginning just behind end of spiny dorsal fin, its rays 35 to 36. Anal fin origin on level with eighth or ninth dorsal fin ray, its rays 31 to 32. Length of caudal fin 17 to 20 (19) percent of SL, its principal rays 14 in one specimen, 15 in six specimens and 16 in one specimen. Last procurrent caudal fin ray, both dorsally and ventrally, about half the length of the unbranched principal caudal fin ray behind it. Pectoral fin rounded, its rays 23 to 24, most of them branched, reaching to level of fifth to eighth anal fin ray; its length 22 to 27 (25) percent of SL. Pelvic fin with a spine and 5 well-branched rays, the fourth ray longest, 17 to 22 (19) percent of SL, ending well short of the anus.

Body completely covered with finely ctenoid scales. Scales extending onto caudal fin and lateral surface of pectoral fin. Scales in longitudinal series 84 to 97 (87). Both upper and lower lateral lines without tubular scales.

Ground color of body pale to dark tan, with abdominal and branchiostegal regions lighter. Markings on body variable, usually with numerous large dark blotches laterally or 7 to 8 irregular dorso-ventral cross bars. One specimen had the typical cross-bar pattern when caught, but when placed in a bucket of iced sea water lost its cross bars and turned quite pale, only to regain the cross bars some minutes later, as well as a dark streak along the midlateral line in the anterior half of the body.

Several of the larger specimens are females with well-developed ovaries in which the eggs are about 1.5 mm. in diameter.

Trematomus bernacchii Boulenger

Trematomus bernacchii Boulenger, 1902, p. 181, pl. 14.

By far the largest part of our presently catalogued collection consists of 154 specimens of *T. bernacchii* (86.8-229.3 mm.), all of which were taken from the Ross Sea in McMurdo Sound and Terra Nova Bay (in addition, a substantial number of specimens of this species are still at McMurdo IGY base, awaiting shipment to Stanford). The registered specimens, by stations, are as follows: GL-1-2: SU 53557, one, 160.8 mm.; GL-1-3: SU 53556, one, 192.7 mm.; GL-1-8: SU 53535, one, 199.7 mm.; GL-12: SU 53548, 17, 137.8-214.0 mm.; MM-17: SU 53531, four, 134.6-226.4 mm.; MM-18-1: SU 53524, five, 147.0-196.2 mm.; MM-18-4: SU 53537, four, 144.8-179.8 mm.; MM-18-5: SU 53528, three, 163.3-220.0 mm.; MM-18-6: SU 53549, one, 131.8 mm.; MM-19-1: SU 53517, six, 162.5-210.2 mm.; MM-19-2: SU 53525, ten, 86.8-217.5 mm.; MM-19-3: SU 53518, two, 180.2 and 201.2 mm.; MM-19-4: SU 53552, two, 133.6 and 181.9 mm.; MM-19-5: SU 53532, two, 183.1 and 190.9 mm.; MM-19-7: SU 53550, one, 152.6 mm.; MM-19-8: SU 53551, one, 147.8 mm.; MM-21-1: SU 53554, two, 103.1 and

178.3 mm.; MM-21-2: SU 53529, five, 155.8-188.3 mm.; MM-21-3: SU 53522, eight, 115.6-222.8 mm.; MM-21-5: SU 53533, two, 167.8-189.2 mm.; MM-21-7: SU 53526, one, 93.7 mm.; MM-21-8: SU 53553, two, 101.6 and 113.8 mm.; MM-21-9: SU 53519, four, 99.6-217.4 mm.; MM-21-10: SU 53536, two, 165.1 and 167.1 mm.; MM-21-12: SU 53516, three, 202.7-212.7 mm.; MM-21-13: SU 53520, nine, 99.0-186.9 mm.; MM-21-14: SU 53530, one, 222.0 mm.; MM-23: SU 53521, three, 201.0-229.3 mm.; MM-25-1: SU 53546, 19, 104.9-219.3 mm.; MM-25-2: SU 53547, 10, 110.8-206.4 mm.; MM-25-3: SU 53541, one, 152.4 mm.; MM-25-4: SU 53523, three, 158.8-204.0 mm.; MM-25-6: SU 53544, one, 91.9 mm.; MM-25-7: SU 53527, one, 94.8 mm.; MM-25-8: SU 53534, two, 110.5 and 159.6 mm.; MM-25-9: SU 53538, five, 94.8-153.2 mm.; MM-25-10: SU 53543, two, 112.6 and 116.0 mm.; MM-25-11: SU 53545, one, 94.6 mm.; MM-25-12: SU 53540, two, 95.6 and 142.9 mm.; MM-25-14: SU 53539, two, 165.0 and 180.0 mm.; MM-25-15: SU 53542, one, 156.1 mm.; MM-26-2: SU 53555, one, 101.1 mm.

Length of head 28.2 to 33.1 (30) percent of SL (this proportion, and those that follow, based on 50 specimens, unless otherwise specified). Horizontal diameter of eye 22.0 to 30.6 (26.8) percent of head length. Snout usually slightly longer than eye, 27.8 to 36.2 (31.1) percent of head length. Width of bony interorbital variable, 14.9 to 22.7 (18.2) percent of head length. Maxillary extending posteriorly to level of anterior fifth to half of eye. Branchiostegal rays 6 on each side in 100 specimens examined for this character. Branchiostegal membranes united to one another over the isthmus, and to the isthmus for almost their entire length. Gill rakers short and slender, 11 to 17 (14) on lower limb of first arch (Fig. 1); an elongate opening between fourth gill arch and pharyngeal wall. Pseudobranchiae with 15 to 22 (17) long filaments. Hyoid arch gill rakers 2 to 8 (4), the uppermost often large and wide. Nasal tube with a single opening at its tip, equal in length to one-fourth to one-half the interorbital width. Occiput, opercular and preopercular with finely ctenoid scales; rest of head naked, except for scales that sometimes occur interorbitally anterior to the coronal sensory canal pore. These interorbital scales are always in a single row, and do not occur in two or three rows as in the closely related *T. vicarius* Lönnberg. Figure 1 gives interorbital scale counts, showing a variation of from 0 to 7 scales. Teeth strong, slender, conical; in a single series in each jaw laterally, but becoming irregularly biserial anteriorly; those near the edge of the jaws somewhat longer than those internal to them.

Depth of body 21.5 to 28.3 (25.9) percent of SL. Dorsal fin with 3 to 6 (5) spines (Fig. 1), the first spine on a level slightly anterior to slightly posterior to the top of the pectoral fin base. Soft dorsal fin beginning just behind spiny dorsal fin, its rays 35 to 38 (Fig. 1). Anal fin origin on level between 8th and 12th ray of soft dorsal fin, its rays 31 to 34 (Fig. 1). Caudal fin rounded, its length 13.6 to 19.2 (15.7) percent of SL; the number of principal rays variable, of 50 specimens counted, 20 had 14 principal rays, 17 had 15 principal rays, and 13 had 16 principal rays. Last procurrent caudal fin ray, both dorsally and ventrally, between half and three-fourths length of unbranched principal caudal fin ray behind it. Pectoral fin rounded, its length 17.1 to 23.0 (20.1) percent of SL, reaching to between the level of the anus and the sixth anal fin ray; most of its rays branched, their number 23 to 26 (Fig. 1). Pelvic fin with a spine and 5 well-branched rays; the fourth ray longest, with up to 18 terminal segments in the larger specimens, though smaller specimens have only 7 or 8. Length of pelvic fin 14.6 to 23.6 (19.5) percent of SL, extending posteriorly to a level well short of the anus in the larger specimens, but to or slightly past the anus in smaller specimens. When the average values given above for the pectoral and pelvic fin lengths are compared, the impression given is deceptive, for the values

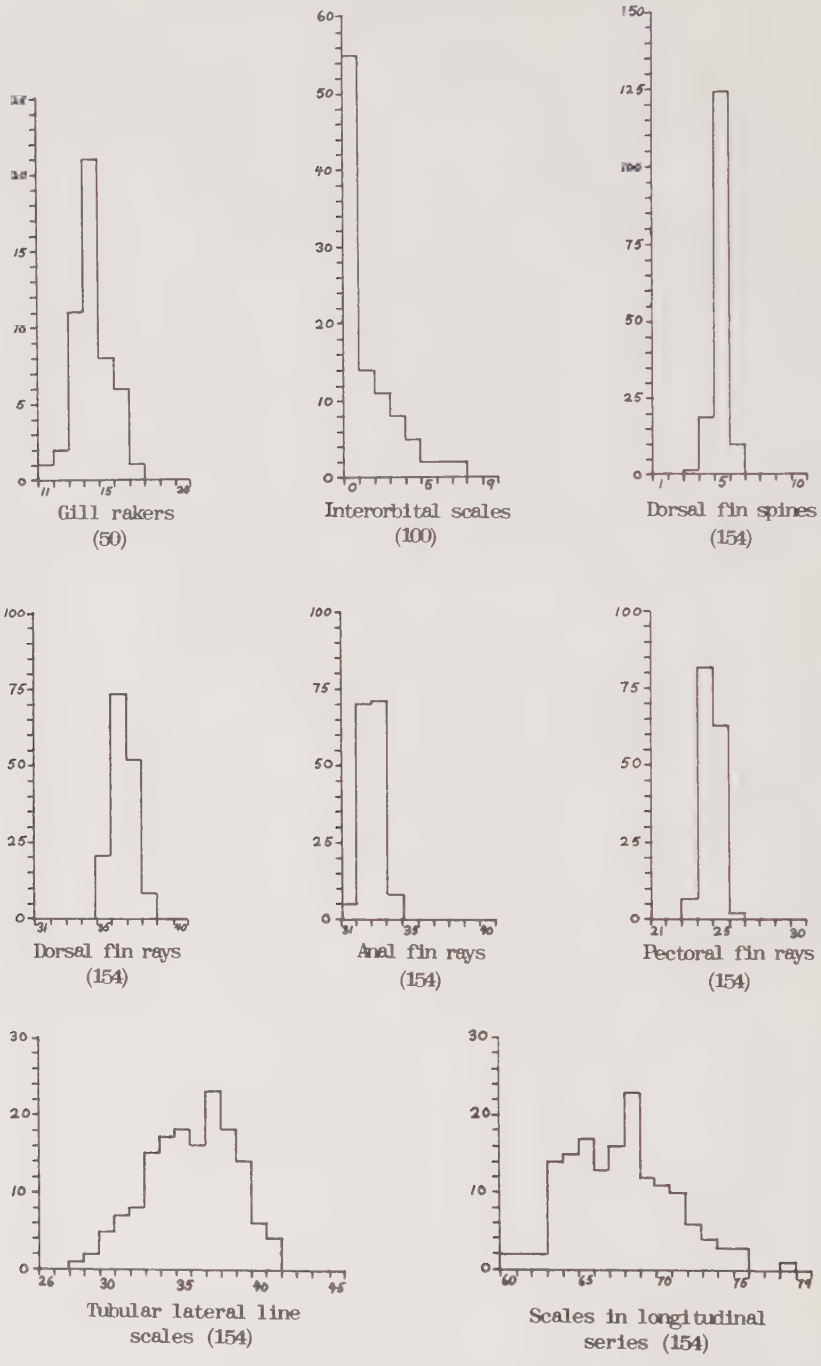

Fig. 1. *Trematomus bernacchii*. Histograms of counts. The axes of abscissas represent counts; the axes of ordinates represent numbers of specimens counted; figures in parentheses are total numbers of specimens counted. (See text for methods of counting.)

are not greatly different, but in most specimens the lengths of these two fins are significantly different. In specimens between 155 and 170 mm. long the pectoral and pelvic fins are about equal in length, while smaller specimens have relatively longer pelvic fins and shorter pectoral fins, and specimens larger than the 155 to 170 mm. group have relatively shorter pelvic fins and longer pectoral fins.

Body everywhere covered with finely ctenoid scales; 60 to 78 (67) scales in a longitudinal series (Fig. 1). Upper lateral line with 28 to 41 (36) tubular scales (Fig. 1). Lower lateral line usually without tubular scales, though occasionally one or two may be present. Scales extending a short distance onto caudal and pectoral fins.

Ground color of specimens light tan to brown, fins darker, abdominal and branchiostegal regions lighter. Body with 5 or 6 irregular dorso-ventral cross-bars.

All of the larger specimens are females with very large ovaries in which eggs are grossly visible. None of the males collected are among the larger specimens.

Trematomus hansoni Boulenger

Trematomus hansoni Boulenger, 1902, p. 180, pl. 13.

Seven large specimens taken in the Ross Sea at McMurdo Sound: MM-17: SU 53560, five, 182.3-240.1 mm.; MM-19-3: SU 53559, one, 172.4 mm.; MM-25-10: SU 53558, one, 188.9 mm.

Length of head 27 to 28 percent of SL. Horizontal diameter of eye 25 to 28 (26) percent of head length. Snout longer than eye, 29 to 34 (32) percent of head length. Bony interorbital broad, 19 to 21 percent of head length. Maxillary extending posteriorly about to level of anterior fifth of eye. Nasal tube with a single opening, equal in length to one-third the interorbital width. Each jaw with short and strong conical teeth in a single row laterally, becoming irregularly biserial anteriorly, particularly in the upper jaw. Branchiostegal rays 6, the membranes united over the isthmus, and to the isthmus for almost their entire length. Gill rakers on the lower limb of the first arch 14 to 17 (16); 5 to 9 gill rakers developed on the hyoid arch skin fold, which in the larger specimens are equal in length to the rakers on the lower half of the lower limb of the first gill arch. Pseudobranchiae with about 23 long filaments. A long opening between the fourth gill arch and the pharyngeal wall. Head covered with cycloid or very finely ctenoid scales, except the scaleless upper and lower jaws, the snout anterior to the nostrils, the anterior suborbital area, and the branchiostegal region.

Depth of body 20 to 25 (22) percent of SL. Origin of spiny dorsal fin about on a level with top of pectoral fin base; its spines 7 in three specimens, 6 in the other four specimens. Soft dorsal fin beginning just behind end of spiny dorsal fin, its rays 38 to 40 (39). Anal fin origin on a level with 11th or 12th dorsal fin rays; its rays 34 to 36 (34). Length of caudal fin 15 to 16 percent of SL; with 14 principal rays in five specimens and 15 principal rays in the other two specimens. Last procurrent caudal fin ray, both dorsally and ventrally, about half the length of the unbranched principal ray behind it. Pectoral fin rounded, reaching to a level between the third and eighth anal fin rays; its length 20 to 24 (22) percent of SL, its rays mostly branched, 29 to 31 (30). Pelvic fin with a spine and 5 well-branched rays; the fourth ray longest, reaching almost to the anus in the smaller specimens, but stopping well short of the anus in the larger specimens; its length 17 to 19 percent of SL.

Body everywhere covered with finely ctenoid scales, including the

prepelvic and prepectoral areas. Scales extending a short distance onto the caudal fin and the lateral surface of the pectoral fins, as well as to a slight extent onto the medial surface of the pelvic fins. Scales in a longitudinal series 60 to 72 (68). Upper lateral line stopping short of the end of the dorsal fin, with 42 to 45 (43) tubular scales. Lower lateral line usually without tubular scales, though in several specimens one or two are present.

Ground color of body light to dark tan, abdominal region only slightly paler. Body with 4 or 5 irregular dorso-ventral cross bars. A dark elongate blotch along the axilla of the pectoral fin.

Several of the larger specimens are females with fully ripe gonads, the eggs about 2 mm. in diameter.

Trematomus loennbergi Regan

Trematomus loennbergi Regan, 1913, p. 263, pl. 8, fig. 4.

Two large specimens, SU 53561, 278.5 mm., and SU 53562, 242.5 mm., from Stns. GL-8 and GL-10, respectively, in the western Ross Sea.

Length of head 24 to 25 percent of SL. Horizontal diameter of eye 28 to 29 percent of head length. Snout somewhat shorter than eye, 24 to 25 percent of head length. Bony interorbital region broad, 19 to 20 percent of head length. Maxillary extending posteriorly to level of anterior fourth or fifth of eye. Branchiostegal rays 6, except on the left side of the larger specimen, where only 5 are present. Branchiostegal membranes broadly united to one another over the isthmus, and to the isthmus for about three-fourths of their length. Gill rakers short and somewhat compressed laterally, 13 to 14 on the lower limb of first arch; an elongate opening between fourth gill arch and pharyngeal wall. Pseudobranchiae well developed, with 23 to 25 long filaments. Hyoid arch skin fold with 8 or 9 well-developed gill rakers. Cylindrical nasal tube with a single opening at its tip, its length equal to about one-fourth the interorbital width. Head covered with finely ctenoid scales, except for the scaleless anterior suborbital region, snout anterior to the nasal tubes, upper and lower jaws, and branchiostegal region. Teeth thickly conical and slightly curved, placed in a single close-set row in both jaws laterally, anteriorly more widely and irregularly spaced, but not biserial.

Depth of body 23 to 25 percent of SL. Spiny dorsal fin with 6 spines in each specimen, the first spine on a level with the lower edge of the pectoral fin base. Soft dorsal fin beginning just behind the end of spiny dorsal fin, its rays 34 in both specimens. Anal fin origin on a level with the seventh ray of the soft dorsal fin, its rays 34 to 35.

In both specimens the first element in the anal fin is not particularly flexible, and dissection showed it to be unpaired and unsegmented; therefore we consider it to be a spine. No anal fin spine has been reported before in any nototheniid, nor do we find one in any of the other nototheniid species here described. Caudal fin rounded, with 14 principal rays; the length of its longer rays 14 to 15 percent of SL. Procurrent caudal fin rays well developed, the last of which, both dorsally and ventrally, is between half and three-fourths the length of the unbranched principal caudal fin ray just behind it. Pectoral fin rounded, reaching posteriorly to the level of about the sixth anal fin ray, its length 21 to 22 percent of SL, its rays 28, most of which are branched. Pelvic fin with a spine and 5 well-branched rays, the third ray longest, not quite reaching the anus, its length 17 to 18 percent of SL.

Body everywhere covered with finely ctenoid scales, including the prepectoral and prepelvic areas. Scales extending a short distance onto

the pectoral and caudal fins. About 70 scales in a longitudinal series. Upper lateral line with 47 tubular scales in both specimens; 16 to 17 tubular scales in lower lateral line.

Ground color of body light to dark tan, the abdominal region not particularly paler. Oral and pharyngeal cavities and inner surface of the branchiostegal membranes very darkly pigmented, head region otherwise about the color of body. Body with 4 or 5 irregular dark tan dorso-ventral cross bars. All fins more densely pigmented distally than proximally, except the spiny dorsal fin, which is well pigmented over its entire surface.

Both specimens are females with well-developed ovaries in which eggs are grossly visible, though the ovary is not yet fully ripe.

Trematomus centronotus Regan

Trematomus centronotus Regan, 1914a, p. 12.

Fourteen specimens taken from the Ross Sea at McMurdo Sound from the following stations: GL-1-9: SU 53623, one, 182.5 mm.; GL-2: SU 53624, one, 175.1 mm.; MM-19-2: SU 53639, one, 120.4 mm.; MM-21-2: SU 53640, one, 174.6 mm.; MM-21-3: SU 53641, one, 159.5 mm.; MM-21-5: SU 53642, one, 136.2 mm.; MM-23: SU 53643, one, 126.0 mm.; MM-24: SU 53644, one, 113.5 mm.; MM-25-1: SU 53645, two, 94.8 and 111.3 mm.; MM-25-6: SU 53646, one, 111.5 mm.; MM-25-8: SU 53647, one, 112.3 mm.; MM-25-12: SU 53648, two, 109.7 and 114.4 mm.

Length of head 27 to 31 (29) percent of SL. Horizontal diameter of eye 31 to 35 (33) percent of head length. Snout shorter than eye, 26 to 30 (27) percent of head length. Bony interorbital narrow, 7 to 10 (9) percent of head length. Maxillary extends posteriorly to level between anterior margin of eye and anterior margin of pupil. Branchiostegal rays 6, the membranes united to one another, and to the isthmus for almost their entire length. Gill rakers short and slender, 12 to 15 on lower limb of first arch; an elongate opening between fourth gill arch and pharyngeal wall. Pseudobranchiae with 15 to 21 long filaments. Hyoid arch skin fold with 2 to 6 gill rakers. Nasal tube with a single opening at its tip, its length equal to about half the interorbital width. Head with finely ctenoid scales, except for the scaleless upper and lower jaws, snout anterior to nostrils, anterior suborbital, and branchiostegal regions. Teeth strong and conical, in a single row in each jaw laterally, but becoming irregularly biserial anteriorly, where the outermost teeth are larger than those internal to them.

Depth of body 23 to 29 (26) percent of SL. Spiny dorsal fin with 5 or 6 spines, these being strong in the larger specimens, but weaker, particularly at the tips, in the smaller specimens. Soft dorsal fin with 32 to 36 rays, the distance between its origin and the last spine somewhat greater than interorbital width. Anal fin origin on level with 8th to 10th dorsal fin ray, its rays 29 to 32. Caudal fin rounded, with 13 to 15 principal rays, its length 16 to 18 percent of SL. Last procurrent caudal fin ray, both dorsally and ventrally, equal to about half the length of the unbranched principal caudal fin ray behind it. Pectoral fin rounded, with 24 to 26 rays, most of which are branched, extending posteriorly to level of fourth to sixth anal fin rays, its length 20 to 25 (23) percent of SL. Pelvic fin with a spine and 5 well-branched rays, the third and fourth rays longest, reaching from just short of the anus to the level of the sixth anal fin ray, its length 20 to 28 (23) percent of SL.

The variation in length of the pelvic fins may be related to sex in the larger specimens. Of the specimens larger than 150 mm. SL, two are males and two are females. The pelvic fins in the males reach to the bases of

the third and fourth anal fin rays; those of the females do not reach to the anus. However, the smaller specimens show no correlation between pelvic fin length and sex.

Body everywhere covered with finely ctenoid scales. Scales extending a short distance onto caudal and pectoral fins. Scales in a longitudinal series 52 to 56. Upper lateral line with 29 to 37 tubular scales; lower lateral line without tubular scales.

Ground color of body light tan, abdominal and branchiostegal regions lighter, fins darker. Body with 4 or 5 irregular dorso-ventral cross bars.

We have identified these specimens as *T. centronotus* on the basis of the size of the eye, the narrowness of the bony interorbital, the relative stiffness of the dorsal fin spines as compared with those of other species at our disposal, and particularly on the basis of the descriptions given by various authors of the closely related *T. pennelli* Regan. The types of *T. centronotus* were collected, as were our specimens, at McMurdo Sound, although at greater depth than those at which most of our specimens were taken. It may be significant that our smaller specimens were collected from shallow water (20-80 feet), while our larger specimens were taken from 47 to 320 fathoms.

Trematomus scotti (Boulenger)

Notothenia scotti Boulenger, 1907, p. 2, pl. 1, fig. 1.

Three specimens: SU 53573, 93.1 mm.; SU 53574, 61.2 mm.; SU 53575, 71.4 mm., taken off the west coast of the Palmer Peninsula near the Biscoe Islands, from Stns. ED-8, ED-7, and ED-9 respectively.

Length of head 30 to 31 percent of SL. Horizontal diameter of eye 36 to 39 percent of head length. Length of snout shorter than eye, 23 to 25 percent of head length. Bony interorbital region narrow, 7 to 8 percent of head length. Maxillary extending posteriorly about to the level of anterior fourth of eye. Branchiostegal rays 6, the membranes broadly united to one another over the isthmus, as well as to the isthmus for about three-fourths of their length. Gill rakers short and thick, 12 on the lower limb of the first arch in each specimen; an elongate opening between the fourth gill arch and the pharyngeal wall. Pseudobranchiae well developed, with about 12 long filaments. Hyoid arch skin fold with 5 or 6 weakly developed gill rakers. Olfactory organ with a cylindrical nasal tube equal in length to about three-fourths the interorbital width. Head covered with ctenoid scales, except for the scaleless snout, anterior suborbital region, upper and lower jaws and branchiostegal region. Teeth short and conical, in a single row in each jaw laterally, becoming irregularly biserial to a slight extent anteriorly.

Depth of body 20 to 21 percent of SL. Spiny dorsal fin with 5 spines in two specimens, 6 in the other; the first spine on a level somewhat behind the top of the pectoral fin base. Origin of soft dorsal fin just behind end of spiny dorsal fin, its rays 33 in each specimen. Anal fin origin on a level with the sixth or seventh dorsal fin ray, its rays 30 in two specimens, 29 in the other specimen. Caudal fin rounded, the length of its longer rays 23 to 27 percent of SL, with 14 principal rays. Procurrent caudal fin rays well developed, the last of which both dorsally and ventrally is equal in length to somewhat more than half length of unbranched principal caudal fin ray behind it. Pectoral fin rounded, extending posteriorly about to the level of fourth anal fin ray; its length 21 to 22 percent of SL; its rays 21 in two specimens, 20 in the other; most of the

rays branched. Pelvic fin with a spine and 5 well-branched rays; the third ray longest, its length 23 to 26 percent of SL and extending posteriorly past the anus almost to the anal fin.

Body everywhere covered with finely ctenoid scales, 45 to 48 in a longitudinal series. Upper lateral line short, ending under the first few rays of the soft dorsal fin, with 11 to 14 tubular scales. Lower lateral line without tubular scales. No scales extending onto any of the fins.

Ground color of specimens tan. Head with a large, dark, irregular blotch from the ventro-posterior margin of the eye across the preopercular onto the upper half of the opercular. Suborbital, snout, and flesh over upper jaw darker than rest of head. Body with about 4 dark, irregular, dorso-ventral cross bars. Branchiostegal and prepelvic regions quite pale, as is most of the lower jaw. Abdominal region well speckled with tan. A black blotch on the distal half of the spiny dorsal fin membrane; 3 dark dorso-ventral bars on the pectoral fin; dark speckling on the distal half of the pelvic fin. Other fins speckled about the same as the body.

Pleuragramma antarcticum Boulenger

Pleuragramma antarcticum Boulenger, 1902, p. 187, pl. 18.

Forty-five larvae, post larvae, and young of this species, ranging in length from 7.2 mm. total length to 89.2 mm. standard length, found floating dead in McMurdo Sound from the middle of November, 1958, to late January 1959. The specimens were collected at the following stations: GL-1-3: SU 53578, one, 59.5 mm.; MM-9: SU 53579, one, 34.1 mm.; MM-20-1: SU 53580, one, 9.5 mm. total length; MM-20-2: SU 53581, two, 8.1 and 8.7 mm. total length; MM-20-3: SU 53582, three, 8.9-9.2 mm. total length; MM-20-4: SU 53583, two, 15.7 and 18.1 mm. total length; MM-20-5: SU 53584, two, 8.9 and 31.1 mm. total length; MM-21-4: SU 53585, two, 31.5 and 53.3 mm. SL; MM-21-6: SU 53586, one, 31.4 mm.; MM-21-9: SU 53589, two, 36.4 and 53.0 mm.; MM-21-12: SU 53587, eight, 29.8-38.5 mm.; MM-21-13: SU 53588, eight, 28.2-32.4 mm.; MM-27: SU 53590, one, 89.2 mm.; MM-28-2: SU 53591, two, 7.2 and 9.1 mm. total length; MM-28-5: SU 53592, three, 22.2-30.8 mm. SL; MM-28-6: SU 53593, one, 32.2 mm.; MM-28-7: SU 53594, one, 59.0 mm.; MM-28-8: SU 53595, two, 10.9 and 17.5 mm. total length; MM-29-1: SU 53596, three, 31.8-39.4 mm. SL; MM-29-3: SU 53597, one, 42.5 mm. The remains of 14 adults were found in the stomach of a Weddell seal, but because of their highly digested condition we have neither given this catch a station number nor registered the specimens.

We have little to add to Regan's descriptions and figures (1916, p. 131, pl. 2, figs. 3-6) of the larval stages of this species. Regan (*loc. cit.*) states "that the eggs may hatch out about the beginning of December, that the newly hatched larvae may be 6 mm. long or a little less, that by the winter they may reach a length of 15 to 25 mm., and when a year old may be as much as 35 mm. long." On the basis of this statement, as well as other data which he presents, we can assume that the specimens of 8 and 9 mm. total length listed above and taken in late December are about one month old. The specimens of 30 to 40 mm. standard length would then be about one year old and the larger specimens of 50 to 70 mm. about two years old. Two of the specimens listed above (SU 53583) were caught on Dec. 29, 1958 and were already about 16 and 18 mm. in total length, a size indicative of an age somewhere between two and four months. Even using the lower figure of two months of age it would mean that the hatching had taken place in late October or early November, and thus it may be that the breeding season is of several months' duration, beginning in October and ending in December.

Family HARPAGIFERIDAE

This family contains 10 species, all of which occur south of the Antarctic convergence. Our collection contains representatives of only one of these species.

Dolloidraco longedorsalis Roule

Dolloidraco longedorsalis Roule, 1913, p. 6.

Four specimens taken at stations in southwestern Ross Sea: GL-7: SU 55610, two, 87.7 and 91.0 mm.; GL-8: SU 53611, two, 83.1 and 90.3 mm.

Length of head 40 to 43 percent of SL. Eyes large, placed largely in the anterior half of head, their horizontal diameter 33 to 34 percent of head length. Postorbital length of head 43 to 47 percent of head length. Bony interorbital narrow, 3 to 8 percent of head length. Snout much shorter than eye, its length 22 to 24 percent of SL. A single tubular nostril on each side of snout, its length 5 to 6 percent of head length. A well-developed muscular barbel present at symphysis of lower jaw, its length 39 to 46 percent of head length (barbel damaged in one specimen, and not measured here). Teeth in lower jaw conical and curved slightly inwards, in a single row laterally, but anteriorly forming a patch on either side of the symphysis, the symphysis itself being toothless. Teeth in upper jaw mainly in two rows on each side, but with scattered teeth between the rows; the rows not meeting at the symphysis. Edges of lips minutely fimbriate. Oral membranes well developed, that of the lower jaw broader than that of the upper jaw and with low papillae over its upper surface. Lining of mouth blackish. Maxillary extending posteriorly to about level of pupil of eye. Gill rakers small and blunt, 6 to 8 on lower limb of first arch, 2 to 3 on upper limb. Pseudobranchiae with 6 to 8 long filaments; a small opening present between fourth gill arch and pharyngeal wall. Hyoid arch skin fold colored black, forming a pocket which opens anteriorly, and with a flattened, fimbriate, gill-raker-like tubercle, with usually a smaller one above it. Branchiostegal rays 5, the membranes united to the isthmus.

Depth of body at origin of soft dorsal fin 19 to 21 percent of SL. Lateral line pores 14 to 18 in number, the last 2 or 4 sometimes separated from the rest. Spiny dorsal fin with 3 spines in three specimens, 2 spines in the other specimen. The spines slender and flexible, separated from the soft dorsal by an interspace equal to between 8 and 12 percent of SL. Soft dorsal fin with 22 to 24 rays, the first ray unsegmented, and in one individual quite short. Anal fin with 15 rays. Pectoral fin rounded, reaching to level of second or third anal fin ray; its length 22 to 25 percent of SL, with 17 to 18 rays, most of which are branched. Pelvic fin with a spine and 5 well-branched rays; the fourth ray longest, reaching not quite to the anus or slightly beyond it, its length 19 to 21 percent of SL. Caudal fin long and truncate, 34 to 38 percent of SL, with 11 principal rays in three specimens and 12 principal rays in the other specimen.

It is possible that this species is sexually dimorphic. Two of the specimens (SU 53611) were determined as males on the basis of microscopic examinations of unstained gonadal tissue. The other two specimens (SU 53610) are females whose ovaries contain readily distinguishable eggs. In the females the spiny dorsal fin is relatively short and the mental barbel bears a small, distal expansion. In the males the spiny dorsal fin is relatively long and the mental barbel is simple (one male specimen has a damaged mental barbel with the tip broken off, its length 30.6 percent of

head length compared to 38.8 to 45.7 percent of head length for the three other specimens; there is no indication that the variation in length of the mental barbel is determined by sex). In the males the length of the first dorsal fin spine is 28.4 and 29.5 percent of SL; in the females it is 18.1 and 19.5 percent of SL. These observations may seem in conflict with the literature, for Norman (1938, p. 49) stated that a female specimen had a simple barbel and Waite (1916, p. 24) reported a specimen with a large distal expansion on the mental barbel and with a relatively high spinous dorsal fin. Unfortunately Waite did not determine the sex of his specimen. This leaves the matter somewhat confused, but until more specimens have been collected it will not be possible to determine with assurance whether sexual dimorphism does in fact exist in this species.

Family BATHYDRACONIDAE

This family contains 14 species found only in the Antarctic. Our collection contains only two species of this family, one of which is new.

Bathydraco wohlschlagi, new species
Figures 2, 3 and 4

The holotype, SU 53612, 113 mm. SL, a ripe female from Stn. GL-4, and the paratype, SU 53613, 71.4 mm., from Stn. GL-7, were taken from between 300 and 400 fathoms in the southwestern Ross Sea.

Both specimens possess the following essential characters of the genus *Bathydraco*, as defined by Regan (1913, p. 281) and Norman (1938, p. 54): opercular with a postero-dorsally curved bony extension without spines, the projection having a blunt end, a concave upper surface, and a gently convex lower surface that merges with the main body of the opercular; body scaled; gill rakers well developed; a single lateral line; a band of small villiform teeth in each of the jaws of the spatulate snout; gill membranes united for only a short distance anteriorly, separated and free from the isthmus posteriorly.

This new species possesses but 6 branchiostegal rays, differing in this respect from the five previously described species of *Bathydraco*, all of which have 7 branchiostegals (Regan, *loc. cit.*; Norman, *loc. cit.*).

Head generally depressed, the snout spatulate. Abdominal region of body rounded; body posterior to the anus somewhat compressed laterally, the depth decreasing gradually toward the slender, more rounded, caudal peduncle. Caudal fin rounded. See Table 1 for list of measurements for the two specimens.

Length of head 34.2 and 32.7 percent of SL. Here, as elsewhere in this description, the first proportional measurement or meristic count is that of the holotype, the second the paratype. Lower jaw projecting slightly in front of the somewhat protractile upper jaw, extending posteriorly to the articular-quadrate joint at the level of the posterior margin of pupil. Maxillary extending posteriorly to level of anterior margin of eye in the holotype, and almost, but not quite, this far in the paratype. Premaxillary forming border of upper jaw, except for a very short distance at posterior portion where premaxillary ends somewhat short of maxillary. The posteriorly directed medial process extending from each of the premaxillaries (to facilitate the protraction of the bone) is equal in length to about two-thirds the width of the bony interorbital. The small villiform teeth of the upper jaw are confined to a band on the premaxillary that extends

almost to its posterior end; maxillaries toothless. Teeth in lower jaw similar, present along its length to its angle with the upper jaw. Nasal cavity opens to exterior through a single pore at top of a cylindrical nasal tube placed midway between tip of upper jaw and anterior edge of eye; the tube length about half the bony interorbital width. In the midline of the snout just anterior to the level of the nasal tubes a slight bony protuberance is present, reminiscent of a weakly developed rostral spine. Eye placed just above a horizontal level through dorsal surface of posterior end of upper jaw, anterior edge of eye on a level with end of upper jaw. Horizontal diameter of eye 25.4 and 24.9 percent of head length. Least width of bony interorbital 9.1 percent of head length in both specimens. Length of snout 32.4 and 33.5 percent of head length. Head naked except for a patch of about 15 to 20 thin, cycloid, or very weakly ctenoid scales on upper half of preopercular and upper fourth of opercular areas. Gill rakers well developed, 8 on upper limb of first arch in both specimens; 20 and 18 present on lower limb of first arch; no gill raker at angle between two limbs. Lengths of gill rakers near angle of the two limbs equal to about four-fifths width of bony interorbital; the gill rakers gradually decrease in length anteriorly. Gill rakers of the medial series on first arch short but strong stubs, with small villiform teeth on their rounded ends, corresponding in number on lower limb to lateral series of long gill rakers, but with only a few developed on medial surface of upper arm. The second, third and fourth arches each have numerous stubby gill rakers in lateral and medial series. A wide opening is present between the fourth arch and the pharyngeal wall. Pharyngeal teeth, small in size, are present in a narrow band both dorsally and ventrally. Pseudobranchiae present, with about 12 filaments. Hyoid arch skin fold with one weakly developed, slender, cylindrical "gill raker".

As the sensory canal system of the head has never been described adequately for any species of this genus, an account of the gross structure is given below, following the species description, and illustrated in Figures 2, 3, and 4.

Dorsal fin with 31 and 33 rays, length of its base about 47 percent of

Measurements	Holotype SU 53613	Paratype SU 53612
Standard length	113.0	71.4
Length of head	38.6	23.3
Horizontal diameter of eye	9.8	5.8
Length of snout	12.5	7.9
Width of interorbital (bony)	3.5	2.1
Distance between tip of upper jaw and dorsal fin origin	49.4	30.8
Distance between tip of upper jaw and anal fin origin	63.3	39.4
Greatest body depth	14.5	8.1
Length of dorsal fin base	51.0	34.5
Length of anal fin base	44.2	27.3
Length of pectoral fin	25.1	15.2
Length of pelvic fin	23.1	13.2
Length of caudal fin	18.9	12.5
Length of caudal peduncle	10.1	5.8
Depth of caudal peduncle	4.5	2.5

Table 1. Measurements in millimeters of the types of *Bathydraco wohlschlagi*, new species.

SL, distance between tip of upper jaw and base of its first ray about 43 percent of SL. The first ray about half the length of the second, the second about a third shorter than the third, the third to seventh rays somewhat elevated, the rays posterior to this gradually decreasing in length. The fourth to eighth rays in the holotype are branched, the others simple; but in the smaller paratype all the rays are simple. Anal fin with 26 rays in both specimens, the length of its base about 39 percent of SL, the distance between the tip of the upper jaw and the base of its first ray about 55 percent of SL. The first anal fin ray is on a level with the eighth or ninth ray of the dorsal fin, and about the last 4 anal fin rays are posterior to the level of the last dorsal fin ray. The fifth and sixth anal fin rays of the holotype are branched, the rest are simple; but all the anal fin rays of the paratype are simple. Caudal fin rounded, its length 16.7 and 17.5 percent of SL, with 12 principal rays. A number of procurrent rays are also present, the last of which, both dorsally and ventrally, is much longer than those anterior to it, being about half the length of the unbranched principal caudal fin ray just behind it.

Pectoral fin rounded, placed under posterior portion of opercular flap, the longest ray about 22 percent of SL, extending to the level of about the 12th dorsal fin ray. Its dorsalmost 2 rays and ventralmost 6 or 7 rays unbranched, the others branched. The pelvic fin is I,5, with a well-developed spine, equal in length to about three-fourths that of the longest pelvic rays. All 5 rays are branched, the second and third the longest, extending past the anus almost to the first anal ray (20.5 percent of SL) in the holotype, but not quite to the anus (18.5 percent of SL) in the paratype.

Body more or less rounded in the abdominal region and becoming compressed laterally between the dorsal and anal fins posterior to the anus. Greatest depth of body 12.8 and 11.3 percent of SL. Caudal peduncle rounded, in length (from base of last anal fin ray to base of middle caudal fin ray) about 9 percent of SL, in depth about 4 percent of SL.

In contrast to the very restricted scaled area of the head, the body is well covered with ctenoid scales; there are about 10 ctenae on the scales near the middle of the body. Scales on sides of body lie in irregular, only slightly oblique, rows; about 90 such rows in region between dorsal edge of base of pectoral fin and base of caudal fin. There are about 7 scales in a row from dorsal fin origin postero-ventrally to midlateral groove of body, and about 8 scales from anal fin origin antero-dorsally to midlateral groove of body. The scales do not continue onto the caudal fin. There are approximately 20 scales between occiput (posterior edge of medial vacuity of supratemporal canal - see below) and origin of dorsal fin. Abdominal, prepectoral and prepelvic areas are scaled, the prepelvic scales extending anteriorly about half the length of the isthmus.

The lateral line contains 9 well-developed scales with dorsal and ventral edges upturned, approximating a tube. They lie in a series starting just posterior to first vacuity of otic canal (see below), and ending above first third of pectoral fin, and a little before origin of dorsal fin (see Fig. 3. The first few scales of this series are hidden by the top of the opercular). The 9 upturned scales are roofed over by membrane and enclose a canal which opens anteriorly into the first vacuity of the otic canal. The first upturned scale forms a complete bridge over the canal, but the 8 scales following it form incomplete bridges. A series of 8 or 10 thin cycloid scales, each with a pit in the middle of its upper surface, lie posterior to the series of 9 scales with upturned edges.

The holotype is a female whose ovaries contain eggs 1.5 to 2.0 mm. in diameter. The paratype was partially cleared and stained with alizarin to verify the presence of perforations in the thin cycloid scales mentioned above; to be certain that no small slender seventh branchiostegal ray had

Figs. 2, 3 and 4. Fig. 2. *Bathydraco wohlschlagi*, holotype, SU 53612, female. Standard length 313 mm. From Stn. GL-4. Fig. 3. Same, dorsal view of head. Fig. 4. Same, ventral view of head.

been overlooked; and to more surely differentiate between complete and incomplete bridges in the sensory canal system of the head (see below).

The sensory canal system of *Bathydraco wohlschlagi* includes 5 series: the paired preopercular-mandibular, infraorbital, otic or temporal, and supraorbital canals; and the transverse supratemporal canal. Each canal is a series of large, deep, interconnected vacuities running through or above the head bones. Bony bridges overlie the canals between the vacuities, although these bridges are in some cases incomplete, the two rami not meeting in the middle (whether a bridge is complete or incomplete can not always be seen without staining the bone). The entire canal system is covered by thin membrane through which the vacuities may be seen between the bridges. The vacuities may or may not open to the outside through pores, which, when present, are simple openings, without upraised or inturned edges. The number, position and shape of the vacuities in each series of canals, the structure of the bony bridges between the vacuities, the presence or absence of pores in the membranes over the vacuities, the size, shape and position of the pores, when present, in the membranes will be noted below, for these factors may well prove to be of considerable importance in any revision of this family of fishes.

The preopercular-mandibular canal has 8 spacious vacuities, each with a pore. Of the 7 regions overlying the canal between the successive vacuities, 6 are completely bridged over by either the preopercular or the dentary, and one is incompletely bridged over. The first vacuity with its associated pore is the uppermost on the preopercular, and the eighth, and last, is near the symphysis of the lower jaw. The first vacuity lies along the posterior edge of the preopercular at the level of the bottom half of the eye. The pore is relatively oval, lying at the postero-dorsal end the membrane over the first vacuity. The second vacuity lies just below the first and just above the angle of the preopercular. The second pore is somewhat more elongate than the first pore, lying along the postero-ventral half of the membrane over the second vacuity. The preopercular bridge between the first and second vacuities is narrow, but complete. The third vacuity lies at the angle of the preopercular, its pore a long slit along most of the postero-ventral edge of the membrane over the vacuity. The preopercular bridge between the second and third vacuities is complete, narrow, and slightly longer than the first bridge. The fourth lies along the ventral edge of the preopercular on a level just behind the posterior margin of the eye, its pore a slit along the entire ventral margin of the membrane over the vacuity. The preopercular bridge between the third and fourth vacuities is complete and broader in the middle than are the two previously described bridges. The fifth vacuity lies along the articular area of the lower jaw, and is somewhat larger than the four previously described vacuities. The fifth pore is rectangular in shape, the largest in the series, and is placed in about the middle of the membrane roofing the fifth vacuity. The preopercular bridge between the fourth and fifth vacuities is incomplete; the rami do not meet in the middle and are somewhat weakly developed. The sixth vacuity lies just below the end of the maxillary and is the largest vacuity in this series. The sixth pore is about three-fourths the size of the fifth pore and lies in the middle of the membrane over the sixth vacuity. The dentary bridge between the fifth and sixth vacuities is by far the largest of the bridges, it being complete and very broad, with a width equal to about three-fourths the diameter of the pupil of the eye. The seventh vacuity lies about midway along the length of the lower jaw from its tip to its angle with the maxillary, on a vertical level with the nasal tube. The seventh pore is placed towards the lateral edge of the membrane over the seventh vacuity and is oval in shape. The dentary bridge between the sixth and seventh vacuities is complete and well developed, wider than any of the preopercular bridges and about half

as wide as the dentary bridge just posterior to it. The eighth vacuity lies just lateral to the symphysis of the lower jaw, its pore at the anterior edge of the membrane over the vacuity. The dentary bridge between the seventh and eighth vacuities is similar to the bridge just posterior to it. The canal ends with the eighth vacuity on each side of the lower jaw; there is no connection across the symphysis.

The intraorbital canal has pores in each of the membranes overlying its 7 interconnected vacuities. The first vacuity and associated pore of the series is the dorsalmost of those posterior to the eye, and the seventh is just in front of the nasal tube. The first vacuity lies just behind the ventral half of the posterior edge of the eye, its covering membrane with a slit-like pore in the ventral half of its posterior margin. The second pore is a small slit on the ventral margin of the membrane overlying the second vacuity, which is just below the posterior ventral curve of the eye. The bridge between the first and second vacuities is incomplete; its bases are wide, but the rami do not quite meet in the middle. The third pore is a small slit on the ventral margin of the membrane overlying the third vacuity, which is just below the pupil of the eye. The bridge between the second and third vacuities is similar to that behind it. The fourth pore is a slightly oval opening at the ventral margin of the membrane overlying the fourth vacuity, which is below the anterior half of the eye. The bridge between the third and fourth vacuities is incomplete. The fifth pore is a rectangular opening along the ventral margin of the membrane overlying the fifth vacuity, which is on a level just in front of the angle of the jaws. The bridge between the fourth and fifth vacuities is very narrow in the middle, and probably complete. The sixth pore is a rectangular opening, similar to the fifth pore, in the ventral margin of the membrane overlying the sixth vacuity, which is just below the nasal tube. The bridge between the fifth and sixth vacuities is very narrow, and probably complete. The seventh, and last, vacuity of the infraorbital series is just above the anterior region of the sixth vacuity and just in front and slightly lateral to the nasal tube. The seventh pore is a rounded opening on the medial half of the membrane roofing the seventh vacuity. The bridge between the sixth and seventh vacuities is narrow, but complete.

Whereas the preoperculo-mandibular canal is not connected to the canals on the top of the head, the infraorbital canal is connected from its first vacuity into the first vacuity of the supraorbital canal. This supraorbital canal is in turn connected to the third, and last, vacuity of the otic or lateral canal.

The canals on the top of the head are in 3 series, the transverse, supratemporal canal of 3 interconnected vacuities, the paired otic or lateral canals of 3 interconnected vacuities each, and the paired supraorbital canals with 5 interconnected vacuities each and one vacuity shared in common. The vacuities of the supratemporal and otic canals are roofed over by membranes in which no pores are present. In the supraorbital canals only the anterior 3 of the 5 vacuities of each side have pores in the roofing membranes.

The supratemporal canal consists of a medial vacuity with a lateral vacuity on each side of it. There are no pores in the membranes covering these interconnected vacuities. The medial vacuity is laterally elongate, its diameter between the 2 bridges separating it from the lateral vacuities being about equal to the width of the bony interorbital, while its anteroposterior width is about half the length of its long diameter. The bridges between the medial and lateral vacuities of each side are incomplete; their bases are broad, but the rami do not meet in the middle. The lateral vacuities have the long diameter equal to about three-fourths the long diameter of the medial vacuity.

The otic canal consists of three interconnected vacuities whose roofing

membranes lack pores. The first vacuity is just anterior to the attachment of the opercular flap to the body wall, a well-developed, complete bridge separating it from the first vacuity in the lateral line of the body proper. This distinction between the first vacuity of the otic canal and that of the first vacuity of the lateral line is somewhat arbitrary, for what is here considered as the first vacuity of the lateral line is of quite the same structure as those of the otic series, differing only in its smaller size and its position posterior to the attachment of the opercular flap to the body. The second vacuity of the otic canal lies just below the lateral vacuity of the supratemporal series and is interconnected to it but superficially separated from it by an incomplete bridge. The third vacuity of the otic canal is separated from the second vacuity by an incomplete bridge, as is the second vacuity from the first. Just in front of the third otic vacuity is the large first vacuity of the supraorbital canal; these two vacuities are interconnected under an incomplete bridge.

The first vacuity of the supraorbital canal lies just behind the upper posterior edge of the eye, and the sixth, and last, is anterior to the nasal tube. The first vacuity is large and almond shaped, its long diameter slightly greater than the bony interorbital width, roofed by a membrane without a pore, separated from both the first infraorbital and third otic vacuities by incomplete bridges. The first supraorbital vacuity is connected from its ventral surface to the first infraorbital vacuity just below it, and from the ventral part of its posterior surface to the third otic vacuity just behind it. The second supraorbital vacuity is situated over the postero-dorsal curve of the eye, is small and more or less circular, covered by a membrane without a pore, and separated from the first vacuity by a strong complete bridge. The third vacuity lies medially in the interorbital region above the posterior half of the eye, roofed by a membrane without a pore, separated from the second vacuity of each side by a strong complete bridge. It is similar in size and shape to the first vacuity, except that its long diameter is somewhat greater. This third vacuity ("coronal" in position) is the only unpaired vacuity of the supraorbital series, and is shared alike by both the right and left canals. The fourth vacuity is in the interorbital region above the anterior third of the eye, its roofing membrane bears an oval pore opening along the anterior three-fourths of its lateral margin. A strong complete bridge separates each of the fourth vacuities from the single third vacuity. The fifth vacuity is postero-medial to the nasal tube, its roofing membrane pierced by a large oval opening along most of its lateral margin, separated from the fourth vacuity by a well-developed, complete bridge. The sixth, and last, vacuity is situated in front of, and medial to, the nasal tube. It is large and elongate, broad in front and narrow posteriorly, without well-defined borders superficially, separated from the fifth vacuity by a very weakly developed, incomplete bridge represented only by a ventral ramus. The pore is a broad opening along the entire anterior margin of the roofing membrane. This last supraorbital vacuity is not connected to the last infraorbital vacuity just lateral to it.

At the present time the authors do not have available specimens of any of the five previously known species of the genus *Bathydraco*, the descriptions of which have all been done rather summarily. For this reason it is difficult to discuss the relationships of *B. wohlschlagi*, although we can distinguish it easily from the other species of the genus, on the basis of the literature.

From the published figures of *Bathydraco*, there would seem to be a great deal of variation between species in the structure and placement of the vacuities and pores of the sensory canal system of the head, but accurate comparison, based on the literature, is impossible, for usually the system is shown incompletely in the figures and barely described in the text.

This is particularly unfortunate, since the configuration of the sensory canal system of the head may have not only specific significance, but may well prove important in any future revision of the genera of the Bathydraconidae, a revision that is very much needed.

Bathydraco wohlschlagi has 6 branchiostegal rays; the other five known species of the genus have 7 branchiostegal rays. While this might seem to distinguish the new species from the others generically, it is, on the basis of the literature, the one such character we could find to separate it immediately from each of the other species. Little information is available on the number of branchiostegal rays in the species of the other seven genera of the Bathydraconidae. In short, any possible generic significance in the number of branchiostegal rays in this family is unknown. Even in the genus *Bathydraco*, it was not until Regan (1913, p. 281) reexamined specimens of *B. antarcticus* Günther (1878, p. 18), originally described as having 10 branchiostegals, and *B. scotiae* Dollo (1906, p. 65), described as having 6, that the correct number of branchiostegals was found to be 7 in each case. The three other species of the genus, *B. macrolepis* Boulenger (1907, p. 4), *B. nudiceps* Waite (1916, p. 27) and *B. marri* Norman (1938, p. 55), were each described as having 7 branchiostegals.

Besides the differences in the number of branchiostegal rays, it is possible to distinguish *B. wohlschlagi* from each of the other species of the genus, again on the basis of the literature, by the presence in *B. wohlschlagi* of the following combination of characters: lateral line with partially tubular scales developed only for a short distance, there being about 9 scales in the series, these followed by a series of about an equal number of small cycloid pitted scales; only the upper half of the preopercular and the upper fourth of the opercular scaled; gill rakers on the lower limb of the first arch 18 to 20; about 90 scales in a longitudinal series; the upper jaw extending to, or nearly to, the level of the anterior margin of the eye; scales on the body ctenoid.

In *B. antarcticus* the partially tubular lateral-line scales number about 60 and extend along the entire length of the body to the base of the caudal fin; the preopercular is completely scaled and the opercular is scaled on its upper half; the number of gill rakers is similar to that of *B. wohlschlagi*, there being about 16 on the lower limb of the first arch; scales in a longitudinal series about 140; the ctenoid scales of the body and the level to which the upper jaw extends posteriorly are as in *B. wohlschlagi*.

In *B. marri* the partially tubular lateral-line scales number about 55 and extend along the entire length of the body to the base of the caudal fin; the preopercular and opercular are almost completely scaled; lower limb of the first gill arch with about 11 gill rakers; scales in a longitudinal series about 125; the upper jaw does not quite reach to the level of the anterior margin of the eye; the body scales are ctenoid as in *B. wohlschlagi*.

In *B. macrolepis* the partially tubular lateral-line scales number about 55 and extend along the entire length of the body to the base of the caudal fin; the preopercular is nearly completely scaled, but the opercular is scaled more or less like that of *B. wohlschlagi*; there are about 11 gill rakers on the lower limb of the first arch; the number of scales in a longitudinal series, the level of the end of the upper jaw and the ctenoid body scales are about the same as in *B. wohlschlagi*.

In *B. scotiae* there are about 40 partially tubular lateral-line scales, but these scales extend only to half to two-thirds the distance between the occiput and the base of the caudal fin; the preopercular is well scaled, but the opercular is scaled about as in *B. wohlschlagi*; there are about 100 scales in a longitudinal series; the upper jaw does not reach to the level of the anterior margin of the eye; the gill rakers and ctenoid body scales are about as in *B. wohlschlagi*.

In *B. nudiceps* the partially tubular lateral-line scales are only 5 or 6 in number and are confined to a short series above the pectoral fin base, followed by a series of imperforate depressed scales that reach (according to Waite, 1916) to the base of the caudal fin, much as in *B. wohlschlagi*, except that in the latter species there are 9 partially tubular lateral-line scales in the short series above the base of the pectoral fin and the series of imperforate depressed scales posterior to this is less developed; the preopercular and opercular are scaleless; there are about 17 gill rakers on the lower limb of the first arch; the upper jaw extends posteriorly to the same level as in *B. wohlschlagi*; the body scales are cycloid (Waite does not mention the number of scales in a longitudinal series).

To speculate briefly on the relationships within the genus *Bathydraco*, it would not seem unlikely that *B. antarcticus*, *B. macrolepis* and *B. marri* are most closely related; *B. nudiceps* and *B. wohlschlagi* are similarly related; while *B. scotiae* is somewhat intermediate between the two groups. In *B. antarcticus*, *B. macrolepis* and *B. marri* the preopercular is well scaled, while the opercular is scaled on the dorsal half in the first; completely in the second; with a small patch dorsally in the third species. In all three species the partially tubular lateral-line scales extend all the way to the base of the caudal fin. The gill rakers on the lower limb of the first arch number about 16 in *B. antarcticus* and about 11 in both *B. macrolepis* and *B. marri*. In the *B. nudiceps* and *B. wohlschlagi* group the head is completely scaleless in the former species and in the latter species the scales are only developed on the dorsal parts of the preopercular and opercular. But more important, the partially tubular lateral-line scales are developed only in the anterior part of the body. The gill rakers on the lower limb of the first arch are 17 to 20. It may also be that the pelvic fins are somewhat longer in *B. nudiceps* and *B. wohlschlagi* than in the other four species of the genus. *Bathydraco scotiae* seems relatively intermediate between the two groups, since it has the partially tubular lateral-line scales extending not all the way to the base of the caudal fin, but rather, only to about half to two-thirds the distance between the pectoral fin and caudal fin bases. The preopercular of this species is well scaled, but the opercular is scaled only on its dorsalmost surface.

This species is named in honor of Dr. Donald E. Wohlschlag, Professor of Biology, Director of the Stanford Antarctic Biological Program, in recognition of the time and effort he spent to assure the success of the systematic ichthyological program, a field not of his own special interest.

Gymnodraco acuticeps Boulenger

Gymnodraco acuticeps Boulenger, 1902, p. 186, pl. 17.

One specimen, SU 53636, 192.1 mm. SL, taken near the surface in McMurdo Sound at Stn. MM-30.

Length of the scaleless, generally depressed head 38.0 percent of SL. Eye 16.7 percent of head length. Bony interorbital wide, 14.6 percent of head length. Depth of head at occiput 12.3 percent of SL. Maxillary reaching to a level just behind the anterior margin of eye. Lower jaw projecting far in advance of upper jaw, the distance between its tip and the end of the upper opercular spine 40.5 percent of SL. Length of the projecting part of the lower jaw equal to almost half the bony interorbital width and bearing 2 (only 1 on the right side) large canine teeth that curve back above the tip of the upper jaw. Upper jaw with 2 or 3 canine teeth anteriorly near the symphysis. Both jaws with a single long series of close-set, sharp, conical teeth extending back posteriorly on each side from the anterior canines. The subopercular with a blunt spine postero-

ventrally. Opercular with a large postero-dorsally directed spine at its upper edge, the spine itself with an anteriorly directed hook on its upper surface near the tip. Branchiostegal rays 6, the membranes united to one another over the isthmus and to the isthmus for their entire length. Gill rakers weakly developed stubs, about 14 on the lower limb of the first arch. Pseudobranchiae well developed, with about 20 long filaments. Area over the ceratohyal and epihyal bearing a fold of skin with very small emarginations. A long opening present between the fourth gill arch and pharyngeal wall. Nostril on each side a single oval opening with a short rim of upturned tissue representing the nasal tube.

Abdominal area of body depressed, its depth 11.0 percent of SL. Body posterior to abdominal region rounded, but becoming laterally compressed in the caudal peduncle. Dorsal fin without spines, its rays 28, beginning on a level above the last third of the pectoral fins. Anal fin origin on a level with about the seventh or eighth dorsal fin rays, composed of 25 rays. Caudal fin truncate, with 13 principal rays. Procurrent caudal fin rays well covered by skin. Pectoral fin rounded, reaching to the level of the anus, most of its 23 rays branched, its length 18.2 percent of SL. Pelvic fin with a spine and 5 well-branched rays; the fourth ray longest, reaching to a level between the end of the first third or half of the pectoral fin.

Body scaleless, except for the lateral lines. Upper lateral line with 14 scales, the scales being tubular anteriorly, but only perforate posteriorly, the line ending on a level with the first few dorsal fin rays. Lower lateral line composed of 39 perforate, non-tubular scales beginning on a level with the dorsal fin origin and ending at the caudal fin base.

Family CHAENICHTHYIDAE

This family consists of 15 known species, of which 12 inhabit Antarctic waters. The Stanford collection contains the young of two of these species and one large specimen of a new species.

Pagetopsis macropterus (Boulenger)

Champsocephalus macropterus Boulenger, 1907, p. 3, pl. 2.

Eight late larval specimens were found floating dead in McMurdo Sound, all between 12 and 14 mm. in total length, from the following stations: MM-20-2: SU 53599, one; MM-20-4: SU 53600, five; MM-20-5: SU 53601, two.

Dorsal and anal fins represented only by fin folds without rays; caudal fin with weakly developed rays. Pectoral fin well developed, though short. Pelvic fin quite long, 33 to 35 percent of total length, its membranes black. Eye large, 10 to 12 percent of total length. Length of head about equal to that of pelvic fins. Jaws extending slightly past posterior margin of eye.

Our specimens, 12 to 14 mm. in total length, correspond very well to the figure given by Regan (1916, pl. 3, fig. 3) for a specimen of this species 19 mm. in total length, and are far past the developmental stage figured by Regan (*loc. cit.*, pl. 3, figs. 1 and 2) for his specimens of 14 and 15 mm. total length. There is evidently a great deal of variability in the degree to which the major morphological characters are developed for any particular total length of the specimen.

We refer our readers to Regan's figures, cited above, for a better description than we can give in words.

Cryodraco antarcticus Dollo

Cryodraco antarcticus Dollo, 1900, p. 129.

Two late larval specimens found floating dead in McMurdo Sound, the larger, SU 53603, 40.9 mm. SL, from Stn. MM-21-12, the smaller, SU 53602, 29.1 mm. SL, from Stn. MM-21-4.

Head generally pale, but with pigment dispersed over the opercular region, lateral edges of the lower jaw, and particularly over the snout. A small median blotch of pigment in the interorbital region immediately between the eyes, and a pair of larger blotches, which tend to fuse medially, just between and partially behind the postero-dorsal part of the eyes. The well-developed opercular spine of the adult is represented by an obvious rudiment; a smaller rudiment of a rostral spine that is reduced or absent in the adult is also present. No other spine rudiments present. The nostrils are rather elongate slits just in front of the eyes in the smaller specimen, but less elongate in the larger specimen. The angle of the jaws is at the level of the pupil of the eyes. Contrary to the condition on the adult, the tip of the lower jaw of the smaller specimen extends forward slightly beyond that of the upper jaw, but in the larger specimen the jaws are terminal. In both specimens the tip of the lower jaw carries a small anteriorly directed fleshy protuberance. The length of the snout can be measured accurately only in the larger specimen, in which it is 56.3 percent of the head length.

Pectoral, pelvic and caudal fins developed, but dorsal and anal fins represented by median folds without fin rays. Lateral rays of the long pelvic fin slightly longer than those medial to them. Pelvic fins of the larger specimen relatively longer than in the smaller specimen. Melanophores in pelvic fin membranes increasing in number distally, with the membrane between the first (lateralmost) and second rays strongly pigmented throughout its entirety. Caudal fin rays weakly developed, but apparently there are 12 principal ones. Caudal fin pale distally, but pigmented along the bases of the rays. Pectoral fin lightly pigmented with scattered melanophores. Dorsal and anal fin folds with a few scattered pigment cells. The body is pale, with melanophores confined to the lines between the myomeres. In the smaller specimen there are about 61 myomeres, in the larger specimen there appear to be slightly more than 60, but the condition of this specimen makes a more precise statement unwise. Regan (1916, p. 133) gives the number of myomeres in this species as 62.

The following counts and proportional measurements were also taken, the larger specimen being listed first in each case: pectoral fin rays 23 and 22, the length of the longest rays 18.3 and 18.2 percent of SL; pelvic fin with 6 elements (to become I,5 in the adult), the length of the longest rays 53.0 and 35.1 percent of SL; greatest depth of the body 9.3 and 12.1 percent of SL; length of head 29.1 and 32.7 percent of SL; horizontal diameter of eye 20.8 and 24.2 percent of head length.

Chionodraco myersi, new species

Figures 5 and 6

The unique holotype of this species, SU 53515, 255.0 mm. SL, was taken in the southwestern Ross Sea off Terra Nova Bay from 345 fathoms at Stn. GL-8.

Fig. 5. Lateral view of *Chionodraco myersi* drawn from the holotype, SU 53515. The illustration shows the specimen as preserved with its mouth open. The following should be noted: the curvature of the upper jaw is due to a broken premaxillary and a bent maxillary; the preopercular and opercular bones have been raised to an almost horizontal position exposing the gill membrane and branchiostegal rays (compare with Fig. 6); the apparent depth of the head and anterior part of the body is probably greater than it would be with the mouth closed and the operculum in a normal position.

Fig. 6. Dorsal view of head of *Chionodraco myersi* drawn from the holotype, SU 53515. The following should be noted: the view of the head is slightly to the right of the middorsal line; the curvature of the premaxillaries and maxillaries causes the posterior ends of the upper jaw to appear anterior to their normal position (see Fig. 5).

Chionodraco myersi differs from the two previously known species in the longer pelvic fins, which reach beyond the tips of the pectoral fins when appressed, and in the absence of a crenulated supraorbital ridge and of a rostral spine.

Head large, somewhat depressed; body elongate, naked, slightly compressed, its greatest depth just behind head; depth decreasing posteriorly. Two dorsal fins, the first short and composed of flexible spines, separated by a short interspace from the second fin, which is long and composed of soft rays. Pectoral fins large and broad, placed at about the middle of the side of the body. Pelvic fins long and slender, reaching beyond the ends of the pectoral fins. Anal fin long, similar to soft dorsal fin except for its more posterior origin. Posterior margin of caudal fin slightly rounded.

These detailed measurements for the holotype are in millimeters. Standard length 255.0; head length 90.3; interorbital width 20.8; snout length 42.6; snout tip to median rostral knob 9.03; snout tip to left nostril 32.2; left orbit to left nostril 8.07; bony orbital diameter (horizontal) 19.3; gape of mouth about 44.7; body depth at interspace between dorsal fins 43.2; least depth of caudal peduncle 11.2; length caudal peduncle 17.6; snout tip to origin first dorsal fin 88.5; last spine of first dorsal fin to first ray of second dorsal fin 9; anal fin origin to base of last (fifth) ray of left pelvic fin 40.6; base of first dorsal fin 21.1; base of second dorsal fin 117.8; width of pectoral fin base 20.6; width of pelvic fin base 6.2; anal fin base 109.5; length of caudal fin 33.5.

First dorsal fin spines VII. Length of first spine 38.9 mm.; second spine 40.8; third spine 39.4. Second dorsal soft rays 39. Length first ray 9.8 mm.; second ray 15.9; sixth ray 21. Pectoral fin rays 21. Rays of left pectoral fin measure: first ray 9.0 mm.; second ray 54.1; third ray 55.5; fourth ray 55.5; fifth ray 53.4; sixth ray 51.8; seventh ray 50.6; 13th ray 48.8; 14th ray 48.3; 15th ray 46.7; 16th ray 44.3; 17th ray 42.4; 18th ray 37.7; 19th ray 31.5; 20th ray 26.3; and 21st ray 19.1. Pelvic fins I,5. Left pelvic fin measures: pelvic fin spine 46.2 mm.; first pelvic ray 66.5; second ray 71.6. Anal fin I,36. Anal fin spine 1.6 mm.; first anal fin ray 14.0; sixth ray 19.1; last ray 2.4. Caudal fin principal rays 13. Lower unbranched principal caudal ray 25.9 mm.; lowermost branched ray (11th branched ray from above) 32.0; tenth branched ray from above 35.0; fifth branched ray from above 33.5; uppermost branched ray (first branched ray) 35.0; upper unbranched ray 27.8.

Length of head, from tip of snout to posteriormost edge of opercular membrane, 35.4 percent of SL. Interorbital space broad and concave, its width 23 percent of head length. Snout rounded in front, 47.2 percent of head length. A small median rostral knob 10 percent of head length from tip of snout. A pair of small lateral knobs overlying the anterior ends of the maxillaries on snout at level of rostral knob. A pair of ridges on top of head, extending from between the eyes to just posterior and lateral to the rostral knob. Posteriorly the ridges are narrow, but anteriorly they broaden, become flattened, and merge with the snout. Nostrils single on each side, tubular, at a distance of 35.7 percent of head length from tip of snout, 8.94 percent of head length from orbit. Eyes large, placed laterally, closer to posterior end of head than to tip of snout. Bony orbital diameter 21.4 percent of head, 93.2 percent of interorbital width. A small blunt spine present at the postero-dorsal edge of eye.

Opercular slender and elongated dorso-ventrally, carrying 2 or 3 posteriorly directed spines on the ventral edge of a postero-dorsally directed process, which ends in an axe-like expansion. Ventrally the subopercular bears a postero-ventrally directed spine. Posterior to the opercular the subopercular is thin and weakly ossified, composed of slender ray-like ossifications, some of which branch, extending postero-dorsally from the

base of the ventral spine in a tough membrane. The interopercular bears a single postero-ventrally directed spine at its posterior end, just in advance of the subopercular spine. The arrangement of the opercular bones is similar to that described and figured by Smitt (1898, p. 12, pl. 1., fig. 15) for *Champsocephalus esox* (Günther) (equals *Chaenichthys esox* in Smitt).

Gape of mouth long, 49.5 percent of head length, reaching to below anterior edge of orbit. Upper jaw rounded at its apex, the lower pointed. Teeth in both jaws slender and conical, arranged biserially. The inner teeth larger than the outer, straight, directed slightly inward. The outer teeth smaller, curved slightly inward. Although the amount of curvature varies, the lower teeth are generally more curved than the upper. The outer teeth of the upper jaw are slightly smaller than the outer teeth of the lower jaw. A tooth selected from the inner row of the lower jaw measures 2.5 mm. (2.77 percent of head length); one from the outer row measures 1.7 mm. (1.89 percent of head length). New teeth of the inner rows appear to develop in spaces left by older dislodged teeth; young teeth are bent inward at a greater angle than older teeth. The outer teeth also appear to develop in place, but the young teeth are erect. Teeth of various sizes are present in both jaws. Two patches of upper pharyngeal teeth are present on each side, a smaller anterior patch separated by a groove from a larger posterior patch. Lower pharyngeal teeth arranged in 4 rows, converging, but not meeting, anteriorly. Oral membranes developed on the inner edges of both jaws, extending back at least three-fourths the length of the jaws. Very small darkly pigmented papillae developed in the flesh along the outer edges of the jaws.

Tongue spoon-shaped, with fleshy lateral edges and scattered small papillae on its medial concave surface; its lateral and anterior edges free. A small slit present between the fourth gill arch and pharyngeal wall. Pseudobranchiae absent. Gill membranes joined to the isthmus and to each other, containing 6 branchiostegal rays on each side.

The lateral line system of the head consists of well-developed supratemporal, infraorbital, supraorbital, and preoperculo-mandibular canals. A lateral canal between the supratemporal and supraorbital canals is not evident externally. A coronal pore is present in the interorbital region. Just anterior and a little to the right of the coronal pore is a pore from the left supraorbital canal. Anterior to and to the right of the latter pore is another from the right supraorbital canal. The tubes leading to these and the other pores in the interorbital region from the supraorbital canals are visible as flat ridges, broad where they leave the canals, and narrowing toward the openings.

The depth of the body decreases steadily from the head to the caudal peduncle, 16.9 percent of SL at the interspace between the dorsal fins. Least depth of caudal peduncle 63.6 percent of its length, as measured between the base of the last anal fin ray and the midbase of the caudal fin. Lateral lines on the body variable. On the right side there are three separate pore series. The upper one, consisting of 102 pores, extends from the level of the origin of the spiny dorsal fin just above the dorsal margin of the opercular membrane, along the upper part of the body near the dorsal fins, to a level about 6 mm. posterior to the end of the base of the soft dorsal fin, at which point it bends abruptly ventrally to end just above the middle lateral line. The middle lateral line consists of 16 pores and is placed in the midlateral line of the body between the level of the base of the last anal fin ray and the base of the caudal fin. There is a vertical branch of 4 pores extending dorsally from the middle lateral line at a level about 2.4 mm. posterior to the ventrally directed end of the upper lateral line. The lower lateral line, consisting of 78 pores, extends from the level of the anus along the ventral part of the body near the anal fin to a level less than a millimeter behind the

base of the last anal fin ray. On the left side the upper and middle lateral lines are united into a single series of 113 pores. There is a vertical branch of one pore from the region along the lateral midline of the caudal peduncle in the same relative position as the vertical branch of 4 pores from the middle lateral line on the right side. The left lower lateral line is similar to that on the right except that it consists of only 75 pores and extends from the level of the base of the first anal fin ray to the level of the last anal fin ray. At the level of the bases of the pectoral fins the upper lateral lines bend slightly upward toward the middorsal line and then continue posteriorly.

Pectoral fins 21, the first ray unsegmented, short, slender, and spine-like, 16.6 percent of the length of the second ray. Second ray undivided, 21.2 percent of SL. Eleventh ray the longest, extending most posteriorly to a level between the bases of the sixth and seventh anal fin rays. Base of pectoral fin broad, 38 percent of the length of the second ray, the upper edge anterior to the lower edge by about 11 mm. The dorsal two thirds of the posterior margin of the fin truncate, the ventral third rounded. Pelvic fins long and narrow, each composed of a slender spine and 5 branched rays. The first two rays the longest, the first 26.1 and the second 28.1 percent of SL, both curving medially near their tips. Both rays are encased distally in heavy skin, and, unless carefully examined, appear to be unbranched. The third ray is about as long as the spine, the latter being 18.1 percent of SL; the fourth and fifth rays are shorter. When appressed, the tip of the second pelvic soft ray reaches to the base of the ninth anal fin ray. Width of base of pelvic fin 13.5 percent of length of its spine.

First dorsal fin composed of 7 slender spines, the length of its base 8.27 percent of SL; its origin directly over the bases of the pelvic fins, a distance of 34.7 percent of SL from tip of snout. The height increases from the first spine (15.2 percent of SL) to the second spine (16.0 percent of SL), and after the third spine (15.4 percent of SL) it decreases abruptly. Second dorsal fin long and low, its length 46.2 percent of SL, and composed of 39 soft rays. The height increases from the first ray (3.84) percent of SL) to the sixth ray (8.24 percent of SL); it decreases gradually between the 8th and 37th rays, and then abruptly to the last ray. All of the rays are unbranched except for the 37th and 38th. A low membranous ridge less than a millimeter in height, continuous with the membrane behind the last spine of the first dorsal fin, is developed in the interspace between the two dorsal fins. Distance between the last spine of the first dorsal fin and the first ray of the second dorsal fin is 3.54 percent of SL. Anal fin similar to soft dorsal fin, originating at a distance of 15.9 percent of SL from the base of the last left pelvic fin ray, its length 42.9 percent of SL, and composed of a short spine and 36 soft rays, all of the latter branched except the last. The spine is quite short (1.6 mm. or 0.451 percent of SL), situated immediately behind the anus, and connected to the first ray by a low membrane. The fin increases in height from the first ray (5.49 percent of SL) to the sixth ray (7.49 percent of SL), while beyond the eighth ray the height decreases gradually until the last few rays, where the fin shortens rapidly to the very short last ray (2.4 mm. or 0.941 percent of SL), giving the end of the fin a rounded appearance. Caudal fin short, its length 13.1 percent of SL, and composed of 13 principal rays.

About 8 irregular purple-brown blotches or bars on body, those behind the end of the pectoral fin extending from the base of the second dorsal fin to the lower lateral line. Anterior to the tip of the pectoral fin the blotches become more irregular, and do not reach to the level of the lower lateral line, continuing onto the dorsal parts of the head. A pair of tear-drop shaped blotches present just behind and medial to the eyes. The whole body is covered by small melanophores causing the lighter areas to

appear finely speckled with black. Yellow-orange overtones present around the bases of the pectoral and pelvic fins. First dorsal fin uniformly blackish; the membranes of all the other fins colorless except at the bases of the caudal and pectoral fins and the membranes between the first and fifth rays of the second dorsal fin where scattered melanophores occur. Melanophores extend out over the rays of all fins.

Chionodraco myersi does not fit easily into Norman's key to the genera of Chaenichthyidae. It lacks a rostral spine, which throws it into the *Chaenocephalus - Cryodraco* group, from both of which it differs in the number of lateral lines (2 in *Chaenocephalus*), the number of dorsal spines (3 to 5 in *Cryodraco*), and the form of the pelvic fin rays (all rays simple in *Cryodraco*). In possessing subopercular and interopercular spines the present specimen agrees with the *Chionodraco - Chaenodraco* group. In the presence of small bump-like gill rakers and I,5 pelvic rays the fish closely approaches *Chionodraco*, from both known species of which it differs in the absence of a rostral spine, and a crenulated supraorbital ridge.

If this fish is to be included in the genus *Chionodraco*, the generic diagnosis (Norman, 1938, p. 78) must be amended to read as follows: Body naked, elongate. Lateral lines variable, without bony plates, usually 3 in number, but the upper and middle occasionally united. A rostral spine present or reduced to a small median knob. Eye somewhat behind middle of head; supraorbital ridges crenulated or smooth. Teeth bi- or tri-serial. Gill rakers absent except for a few vestiges near the angles of the arches. Opercular with a dorsal group of 2 to 5 spines, the uppermost with 2 to 4 points; subopercular and interopercular bearing a pair of spines at the angle where they meet. Spinous dorsal fin well developed, of 5 to 7 spines; pelvics composed of a spine and 5 branched or bifid rays, extending beyond the ends of the pectorals or not, the two outer rays longest and (in the adult) enveloped in thick skin. Skeleton essentially similar to that of *Champsocephalus*. Vertebrae 59 to 64.[2]

Named in honor of Dr. George S. Myers, Professor of Biology, Stanford University, for his interest and help in formulating the Stanford Antarctic Biological Program.

Family MYCTOPHIDAE

Only one species, common to the Antarctic, of this large family of pelagic fishes is represented in the Stanford Antarctic collection. We are indebted to Professor Rolf L. Bolin of Stanford for verifying our identification of these specimens.

Electrona antarctica (Günther)

Scopelus antarcticus Günther, 1878b, p. 184.

Two specimens, SU 53609, 81.0 and 67.4 mm. SL, found floating dead in thin ice in the Cape Norvegia region of the Weddell Sea at Stn. ED-1.

Length of head 25.8 and 26.7 percent of SL; here, as elsewhere in this description, the first figure given refers to the larger specimen, the figure following it to the smaller. Horizontal diameter of eye 37.5 and 37.8 percent of head length. Greatest depth of body 25.2 and 24.6 percent

[2]From radiographs it has been determined that *Chionodraco myersi* has 59 vertebrae (including the urostyle).

of SL. Gill rakers long and slender; 5 on the upper limb, one at the angle, and 12 on the lower limb of the first arch in the larger specimen; the smaller specimen the same except that there are 13 on the lower limb. Maxillary extending to or slightly past the level of the posterior margin of the eye, its posterior edge truncate.

Dorsal fin with 15 rays in both specimens, the last ray divided to the base; length of dorsal fin base 18.2 and 17.2 percent of SL; distance between tip of upper jaw and dorsal fin origin 47.2 and 47.9 percent of SL. Anal fin with 21 rays in both specimens, the last of which is divided to the base; length of anal fin base 28.3 and 28.6 percent of SL; its origin under about the ninth ray of the dorsal fin. Caudal fin with 19 principal rays; about 9 procurrent rays leading to the principal rays both dorsally and ventrally; the longest rays of the forked caudal fin 20.2 and 17.2 percent of SL, the shorter middle rays 9.1 and 9.6 percent of SL. The adipose fin well developed, its base on a level with about the 15th to 18th anal fin rays.

Pectoral fin with 13 rays in both specimens, the middle rays quite long, 25.7 and 24.2 percent of SL, and reaching to about the level of the seventh or eighth dorsal fin rays, almost to the level of the anus. Pelvic fin with 8 rays, its length 13.6 and 12.9 percent of SL, reaching almost, but not quite, to the anus; the distance between the tip of the upper jaw and the pelvic fin base 38.9 and 38.6 percent of SL.

The large lateral-line scales number 40 or 41 in both specimens. There are 4 scales in an antero-dorsally directed series between the lateral line and the anterior region of the dorsal fin base and the same number in a postero-ventrally directed series between the lateral line and the anterior region of the anal-fin base; the medial innermost scale of each series broadly overlaps the lateral-line scale.

The photophores are here described in terms of the abbreviations based on the work of Brauer as used by Parr (1920, p. 51), Norman (1930, p. 317), Frazer-Brunner (1949, p. 1019) and others. PO with 5, the first being about on a level with the posterior edge of the preopercular, while the last is just in front of the lateral edge of the pelvic fin base; PVO with 2, the upper one just above and partially anterior to the lower one, both being on a level with the upper half of the blunt end of the maxillary; PLO with one, just at the ventral edge of the pectoral fin base, and more or less forming a right angle with the PVO series; VO with 4, the first just behind the medial edge of the pelvic fin base and the last just in front of and lateral to the anus; VLO with one, this being well above and slightly posterior to the base of the pelvic fin; SAO with 3, forming a very obtuse angle over the posterior third of the pelvic fin and anterior fifth of the anal fin; AO with 18 (19 on one side of the smaller specimen), the first just above the third anal fin ray and the last 4 posterior to the end of the anal fin base; PRC with 2, just above the ventral series of procurrent caudal fin rays.

There is great variation in the placement of the photophores on the dorsal and ventral surfaces of the caudal peduncle. On the ventral surface of the caudal peduncle of the larger specimen there are 5 dull white, round photophores; surrounding each photophore there is but a slight trace of the dark pigment which surrounds the photophores of the body; there are no photophores on the dorsal surface of the caudal peduncle. In the smaller specimen the 7 photophores on the dorsal surface of the caudal peduncle are surrounded by dark pigment as are those of the rest of the body; the middle photophores are slightly larger than those at each end of the series; there are no photophores on the ventral surface of the caudal peduncle. This difference in the photophores on the dorsal and ventral medial lines of the caudal peduncle may be one that is sex influenced, for gross examination of the gonads leads us to think that the larger specimen is a female and the

smaller is probably a male, and sexual dimorphism of the dorsal and ventral medial series of photophores on the caudal peduncle is known in other lantern fish species.

The photophores of the head consist of a series of 4 well-buried pale white spots along the lower jaw, a series of similar structures just behind the posterior half of the eye and a small irregular series above the upper attachment of the opercular flap. Another such series is found along the anterior margin of the preopercular, but two of the more ventral members of this series are surrounded by dark pigment, making them similar to those of the body region.

The only notable difference between these two specimens and the descriptions of previous authors is in the length of the pectoral fin. The middle rays of the pectoral fin in our two specimens are much longer than those previously described or figured, but in such a wide-ranging circumpolar species as this such a difference is not strange.

ACKNOWLEDGEMENTS

The success of any Antarctic research effort depends on the cooperation of many organizations and individuals. Our present program is no exception to this fact, and although the following acknowledgements may seem lengthy, each is well deserved. We first wish to express our gratitude to the National Science Foundation for financial support, and to the members of the Panel on Biological and Medical Sciences of the Polar Committee of the National Academy of Sciences for their help and advice throughout the program. Dr. L. A. Walford of the Polar Committee assisted with much of the early arrangements for the program. Dr. George A. Llano, also of that Committee, helped in innumerable ways during the entire program. The U.S. Navy Task Force 43 gave invaluable logistic support. We wish especially to state our appreciation to William H. Littlewood, Chief U.S. Navy Oceanographer in the Antarctic with whom Tyler worked aboard the "Edisto", and to J. Q. Tierney, Oceanographer with whom DeWitt worked aboard the "Glacier". We are particularly indebted to Dr. Robert R. Rofen, Director of the George Vanderbilt Foundation at Stanford University, who was instrumental in initiating the program, and who made available to us a substantial amount of collecting gear. We are, as previously mentioned, grateful to Dr. Donald E. Wohlschlag, director of the project, for his help throughout, and to Dr. George S. Myers for his interest and efforts in behalf of the program, as well as for his helpful suggestions during the course of the work leading to this report. Finally, our thanks go to Miss Margaret Storey for her patient editing of this manuscript.

STATION RECORDS

The prefix to each station number indicates whether the specimens were collected from the U.S.S. "Edisto" (ED), the U.S.S. "Glacier" (GL), or through the ice in McMurdo Sound (MM). The stations made from the "Glacier" and at McMurdo Sound occurred in series, the GL stations preceding the MM stations both numerically and in time. We have listed only the stations at which the fishes appearing in this report were collected, and for this reason there are gaps in the station numbers. The following abbreviations are used: fms. for fathoms; yds. for yards; ft. for feet; temp. for tempera-

ture; F. for Fahrenheit; hrs. for hours. A list of the species of fishes taken is given for each station, with the number of specimens in parentheses following the species name.

STATION ED-1: Weddell Sea, west of Cape Norvegia. Lat. 71°40'S., Long. 15°35'W. Depth 850 fms.; 90% ice cover; surface temp. 29°F. January 25, 1959, 1700 hrs. Dip netted from thin ice floating at surface in polynya. *Electrona antarcticum* (2).

STATION ED-2: Weddell Sea, off Duke Ernst Bay. Lat. 77°40'S., Long. 35°30'W. Depth 225 fms.; bottom gritty mud with larger stones; 90% ice cover; surface temp. 30.1°F.; ship drifting about 1/4 knot. January 30, 1959, 1500 hrs. Fish trap 2 fms. below surface. *Trematomus borchgrevinki* (1).

STATION ED-3: Weddell Sea, off Ellsworth IGY Station. Lat. 77°40'S., Long. 40°50'W. Depth 440 fms.; bottom smooth mud with larger stones; 90% ice cover; surface temp. 29.4°F.; current about 3/4 knot. February 1, 1959, 1430 hrs. Fish trap 20 ft. below surface. *Trematomus borchgrevinki* (1).

STATION ED-4: Weddell Sea, off Ellsworth IGY Station. Lat. 77°40'S., Long. 40°50'W. Depth 440 fms.; bottom smooth mud with larger stones; 90% ice cover; surface temp. 29.4°F.; current about 1/2 knot. February 1, 1959, 2000 hrs. Fish trap 15 ft. below surface. *Trematomus borchgrevinki* (2).

STATION ED-5: Weddell Sea, off Ellsworth IGY Station. Lat. 77°40'S., Long. 40°50'W. Depth 440 fms.; bottom smooth mud with larger stones; 90% ice cover; surface temp. 29.4°F.; current about 1/2 knot. February 2, 1959, 1300 hrs. Fish trap 15 ft. below surface. *Trematomus borchgrevinki* (1).

STATION ED-6: West side of Palmer Peninsula, off Victor Hugo Island. Lat. 65°08'S., Long. 66°04'W. Depth 74 fms.; bottom mud with rocks; surface temp. 29.5°F. March 22, 1959, 1500 hrs. Triangular dredge on bottom from drifting ship. *Notothenia larseni* (1).

STATION ED-7: West side of Palmer Peninsula, off Victor Hugo Island. Lat. 65°08'S., Long. 66°04'W. Depth 71 fms.; bottom mud with rocks; 95% ice cover; surface temp. 29.5°F. March 22, 1959, 1700-1950 hrs. Beam trawl on bottom from drifting ship. *Notothenia larseni* (5); *Trematomus scotti* (1).

STATION ED-8: West side of Palmer Peninsula, Biscoe Islands, off Nansen Island. Lat. 66°21'S., Long. 68°21'W. Depth 225 fms.; bottom mud with rocks; 95% ice cover; surface temp. 29°F. March 31, 1959, 0100 hrs. Beam trawl on bottom from drifting ship. *Trematomus scotti* (1).

STATION ED-9: West side of Palmer Peninsula, Biscoe Islands, off Nansen Island. Lat. 65°58'S., Long. 66°51'W. Depth 84 fms.; bottom mud and few stones; 95% ice cover; surface temp. 28.6°F. April 3, 1959, 2300 hrs. Beam trawl on bottom from drifting ship. *Trematomus scotti* (1).

STATION GL-1-2: McMurdo Sound, west of Tent Island. Lat. 77°42'S., Long. 166°12'E. Depth 210 fms.; 99% ice cover. November 11, 1958, 1900-2330 hrs. Ring trap on bottom. *Trematomus bernacchii* (1).

STATION GL-1-3: Same locality as above. November 11, 2330 hrs. - November 12, 0115 hrs., 1958. Ring trap on bottom. *Trematomus bernacchii* (1); *Pleuragramma antarcticum* (1).

STATION GL-1-8: Same locality as above. November 14, 1958, 1520-2015 hrs. Baited hook attached to ring trap on bottom. *Trematomus bernacchii* (1).

STATION GL-1-9: Same locality as above. November 14, 1958, 2020-2315 hrs. Ring trap on bottom. *Trematomus centronotus* (1).

STATION GL-2: McMurdo Sound, east of Marble Point, Victoria Land. Lat. 77°27'S., Long. 164°41'E. Depth 175 fms.; 99% ice cover; surface temp. 29°F. November 17, 1958, 0915-1100 hrs. Wire trap on bottom. *Trematomus centronotus* (1).

STATION GL-4: Southwestern Ross Sea. Lat. 76°31.8'S., Long. 164°55'E. Depth 321 fms. November 27, 1958, 0615-0700 hrs. 4-ft. beam trawl on bottom. Speed of ship 1-2 knots. *Bathydraco wohlschlagi* (1).

STATION GL-7: Southwestern Ross Sea. Lat. 75°46.4'S., Long. 165°15'E. Depth 470 fms. November 29, 1958, 0230-0430 hrs. 4-ft. beam trawl on bottom. Speed of ship 1-2 knots. *Dolloidraco longedorsalis* (2); *Bathydraco wohlschlagi* (1).

STATION GL-8: Southwestern Ross Sea, off Terra Nova Bay. Lat. 75°30'S., Long. 165°44'E. Depth 345 fms. November 29, 1958, 0945-1045 hrs. 4-ft. beam trawl on bottom. Speed of ship 1-2 knots. *Trematomus loennbergi* (1); *Dolloidraco longedorsalis* (2); *Chionodraco myersi* (1).

STATION GL-9: Southwestern Ross Sea, off Terra Nova Bay. Lat. 75°15'S., Long. 165°55'E. Depth 442 fms. November 29, 1958, 1500-1545 hrs. Net towed from ship from bottom to surface. *Pleuragramma antarcticum* (1).

STATION GL-10: Southwestern Ross Sea, off Terra Nova Bay. Lat. 75°06' S., Long. 165°52'E. Depth 455 fms. November 29, 1958, 1545-1700 hrs. 4-ft. beam trawl on bottom. Speed of ship 1-2 knots. *Trematomus loennbergi* (1).

STATION GL-12: Southwestern Ross Sea, Terra Nova Bay, from 50 to 100 yds. from shore. Lat. 74°41.5'S., Long. 164°37'E. Depth 50 to 100 ft.; bottom rocky with algae; shore: rock and ice. November 30, 1958, 1500-1700 hrs. Hook and line and small triangular dredge on bottom. *Trematomus bernacchii* (17).

STATION MM-17: McMurdo Sound, hole in sea ice about 100 yds. south of Hut Point, Ross Island. Lat. 77°51'S., Long. 166°37'E. Depth 81 ft.; bottom sandy mud and cobble; shore: ice and volcanic debris. December 16, 1430 hrs.-December 17, 1445 hrs., 1958. Fish trap on bottom. *Trematomus bernacchii* (4); *T. hansoni* (5).

STATION MM-18-1: About 1 nautical mile north and a little west of Hut Point, Ross Island; about 1/2 nautical mile from shore. Lat. 77°50'S., Long. 166°35'E. Depth 378 ft.; bottom sponge. December 17, 1400 hrs.-Dec. 18, 1330 hrs., 1958. Wire trap on bottom. *Trematomus bernacchii* (5).

STATION MM-18-3: Same locality as above. December 21, 1958, 1530 hrs. Found in slush ice at surface; probably left by surprised Weddell seal. *Trematomus borchgrevinki* (1).

STATION MM-18-4: Same locality as above. December 21, 1530 hrs.-December 22, 1600 hrs., 1958. Wire trap on bottom. *Trematomus bernacchii* (4).

STATION MM-18-5: Same locality as above. December 22, 1600 hrs.-December 23, 1700 hrs., 1958. Wire fish trap on bottom. *Trematomus bernacchii* (3).

STATION MM-18-6: Same locality as above. December 23, 1700 hrs.-December 24, 1515 hrs., 1958. Wire fish trap on bottom. *Trematomus bernacchii* (1).

STATION MM-19-1: Hole in sea ice about 100 yds. south of Hut Point, Ross Island. Lat. 77°51'S., Long. 166°37'E. Depth 81 ft.; bottom sandy mud and cobble; shore: ice and volcanic debris. December 17, 1445 hrs.-December 18, 1430 hrs., 1958. Wire fish trap on bottom. *Trematomus bernacchii* (6).

STATION MM-19-2: Same locality as above. December 21, 1620 hrs.-December 22, 1130 hrs., 1958. Wire trap, and hook and line on bottom. *Trematomus bernacchii* (10); *T. centronotus* (1).

STATION MM-19-3: Same locality as above. December 22, 1958, 1600-1700 hrs. Hook and line on bottom. *Trematomus bernacchii* (2); *T. hansoni* (1).

STATION MM-19-4: Same locality as above. December 23, 1958, 1000-1200 hrs. Hook and line on bottom. *Trematomus bernacchii* (2); *T. nicolai* (1).

STATION MM-19-5: Same locality as above. December 22, 1330 hrs.-December 23, 1600 hrs., 1958. Wire fish trap on bottom. *Trematomus bernacchii* (2).

STATION MM-19-7: Same locality as above. December 30, 1755 hrs.-December 31, 0850 hrs., 1958. Wire fish trap on bottom. *Trematomus bernacchii* (1).

STATION MM-19-8: Same locality as above. January 1, 1630 hrs.-January 3, 0720 hrs., 1959. Wire fish trap on bottom. *Trematomus bernacchi* (1).

STATION MM-20-1: Hole in sea ice about 200 yds. west of Stn. MM-19-1. Lat. 77°51'S., Long. 166°36'E. December 24, 1958, 1445 hrs. Plankton net hung in tide about 100 ft. below surface. *Pleuragramma antarcticum* (1).

Station MM-20-2: Same locality and method as above. December 25, 1958. *Pleuragramma antarcticum* (2); *Pagetopsis macropterus* (1).

STATION MM-20-3: Same locality and method as above. December 26, 1958. *Pleuragramma antarcticum* (3).

STATION MM-20-4: Same locality and method as above. December 29, 1958. 0900 hrs. *Pleuragramma antarcticum* (2); *Pagetopsis macropterus* (5).

STATION MM-20-5: Same locality and method as above. December 30, 1958. 0845 hrs. *Pleuragramma antarcticum* (2); *Pagetopsis macropterus* (2).

STATION MM-21-1: Crack in sea ice about 1½ miles north of Hut Point, Ross Island; from 1/4 to 1/2 mile from shore. Lat. 77°49.5'S., Long. 166° 36'E. Depth 155 ft. to 286 ft.; bottom sponge; shore: ice and volcanic rock. December 26, 1958, 1500-1600 hrs. Fish trap on bottom. *Trematomus bernacchii* (2).

STATION MM-21-2: Same locality as above. December 26, 1958, 2000-2400 hrs. Fish trap on bottom. *Trematomus bernacchii* (5); *T. centronotus* (1).

STATION MM-21-3: Same locality as above. December 27, 1958, 0000-1000 hrs. Fish trap on bottom. *Trematomus bernacchii* (8); *T. centronotus* (1).

STATION MM-21-4: Same locality as above. December 27, 1958, 1015 hrs. By hand at surface. *Trematomus borchgrevinki* (1); *Pleuragramma antarcticum* (2); *Cryodraco antarcticus* (1).

STATION MM-21-5: Same locality as above. December 27, 1000 hrs.-December 28, 1430 hrs., 1958. Fish trap on bottom. *Trematomus bernacchii* (2); *T. centronotus* (1).

STATION MM-21-6: Same locality as above. December 28, 1958, 1430 hrs. By hand at surface. *Pleuragramma antarcticum* (1).

STATION MM-21-7: Same locality as above. December 28, 1430 hrs.-December 29, 0810 hrs., 1958. Fish trap on bottom. *Trematomus bernacchii* (1).

STATION MM-21-8: Same locality as above. December 31, 1958, 0945 hrs.-January 1, 1959, 1350 hrs. Fish trap on bottom. *Trematomus bernacchii* (2).

STATION MM-21-9: Same locality as above. January 1, 1345 hrs.-January 3, 0845 hrs., 1959. Fish trap on bottom, *Trematomus bernacchii* (4); and by hand at surface, *Pleuragramma antarcticum* (2).

STATION MM-21-10: Same locality as above. January 3, 1959, 0830-1520 hrs. Fish trap on bottom. *Trematomus bernacchii* (2).

STATION MM-21-12: Same locality as above. January 3, 0845 hrs.-January 4, 1515 hrs., 1959. Fish trap on bottom, *Trematomus bernacchii* (3); and by hand at surface *Pleuragramma antarcticum* (8); *Cryodraco antarcticus* (1).

STATION MM-21-13: Same locality as above. January 4, 1415 hrs.-January 5, 1600 hrs., 1959. Fish trap on bottom, *Trematomus bernacchii* (9); and by hand and dip net from surface *Pleuragramma antarcticum* (8).

STATION MM-21-14: Same locality as above. January 5, 1550 hrs.-January 6, 1520 hrs., 1959. Fish trap on bottom. *Trematomus bernacchii* (1).

STATION MM-22: Near Ross Island in ice crack about 200 yds. east of Station MM-21-1. Lat. 77°49.3'S., Long. 166°38'E. December 26, 1958, 2330 hrs. By hand at surface. *Trematomus borchgrevinki* (1).

STATION MM-23: In ice crack about 20 yds. off Hut Point, Ross Island. Lat. 77°51'S., Long. 166°37'E. Depth about 20 ft.; shore: volcanic rock. January 7, 1959, 1430-1600 hrs. Hook and line on bottom. *Trematomus bernacchii* (3); *T. centronotus* (1).

STATION MM-24: In ice crack about 20 yds. off Hut Point, Ross Island. Lat. 77°51'S., Long. 166°37'E. Depth about 20 ft.; shore: volcanic rock. January 8, 1959, 1530-1630 hrs. Hook and line on bottom. *Trematomus centronotus* (1).

STATION MM-25-1: In tide crack about 20 yds. off shore of Ross Island at first point south of Hut Point. Lat. 77°51.2'S., Long. 166°39'E. Depth 49 ft.; bottom muddy sand and pebbles; shore: ice and snow. January 9, 1959, 1400-1700 hrs. Hook and line on bottom. *Trematomus bernacchii* (19); *T. centronotus* (2); *T. nicolai* (1).

STATION MM-25-2: Same locality as above. January 10, 1959, 1330-1615 hrs. Hook and line on bottom. *Trematomus bernacchii* (10).

STATION MM-25-3: Same locality as above. January 11, 1959, 1500-1630 hrs. Hook and line on bottom. *Trematomus bernacchii* (1).

STATION MM-25-4: Same locality as above. January 13, 1959, 1600-1700 hrs. Hook and line on bottom. *Trematomus bernacchii* (3).

STATION MM-25-6: Same locality as above. January 16, 1959, 1430-1530 hrs. Hook and line on bottom. *Trematomus bernacchii* (1); *T. centronotus* (1).

STATION MM-25-7: Same locality as above. January 19, 1959, 1100-1200 hrs. Hook and line on bottom. *Trematomus bernacchii* (1).

STATION MM-25-8: Same locality as above. January 20, 1959, 1000-1200 hrs. Hook and line on bottom. *Trematomus bernacchii* (2); *T. centronotus* (1).

STATION MM-25-9: Same locality as above. January 21, 1959, 1000-1100 hrs. Hook and line on bottom. *Trematomus bernacchii* (5).

STATION MM-25-10: Same locality as above. January 23, 1959, 1030-1145 hrs. Hook and line on bottom. *Trematomus bernacchii* (2); *T. hansoni* (1).

STATION MM-25-11: Same locality as above. January 23, 1030 hrs.-January 24, 1115 hrs., 1959. Fish trap on bottom. *Trematomus bernacchii* (1).

STATION MM-25-12: Same locality as above. January 24, 1100 hrs.-January 25, 1545 hrs., 1959. Fish trap and hook and line, all on bottom. *Trematomus bernacchii* (2); *T. centronotus* (2); *T. nicolai* (1).

STATION MM-25-14: Same locality as above. January 27, 1430 hrs.-January 28, 1150 hrs., 1959. Fish trap on bottom. *Trematomus bernacchii* (2).

STATION MM-25-15: Same locality as above. January 28, 1150 hrs.-January 29, 1115 hrs., 1959. Fish trap on bottom. *Trematomus bernacchii* (1).

STATION MM-26-2: Seal hole about 20 yds. from shore in sea ice just northwest of Cape Armitage, Ross Island. Lat. 77°51.5'S., Long. 166°40'E. Depth 17 ft.; bottom muddy, gravelly sand and small rocks; shore: ice and volcanic rock. January 20, 1050 hrs.-January 21, 1015 hrs., 1959. Fish trap on bottom. *Trematomus bernacchii* (1).

STATION MM-27: About 2 miles west of Cape Armitage, Ross Island. January 20, 1959. Chipped out of sea ice with ice axe. *Pleuragramma antarcticum* (1).

STATION MM-28-2: About 50 yds. from shore in tide crack off Cape Armitage, Ross Island. Lat. 77°51.7'S., Long. 166°40.2'E. Depth 16 ft.; bottom muddy sand, gravel and pebbles; shore: volcanic rock and ice. January 20, 1030 hrs.-January 21, 1000 hrs., 1959. Plankton net hung in tide about 10 ft. below the surface. *Pleuragramma antarcticum* (2).

STATION MM-28-5: Same locality as above. January 24, 1015 hrs.-January 26, 1040 hrs., 1959. Plankton net hung in tide about 10 ft. below surface. *Pleuragramma antarcticum* (3).

STATION MM-28-6: Same locality as above. January 27, 1330 hrs.-January 29, 0900 hrs., 1959. Plankton net hung in tide about 10 ft. below surface. *Pleuragramma antarcticum* (1).

STATION MM-28-7: Same locality as above. January 29, 0900 hrs.-January 31, 0945 hrs., 1959. Plankton net hung in tide about 5 ft. below surface. *Pleuragramma antarcticum* (1).

STATION MM-28-8: Same locality as above. January 31, 0945 hrs.-February 2, 1000 hrs., 1959. Plankton net hung in tide about 10 ft. below surface. *Pleuragramma antarcticum* (2).

STATION MM-29-1: About 100 yds. north of Hut Point, Ross Island, in channel broken in sea ice by U.S. Navy icebreakers. Lat. 77°50.8'S., Long. 166°37.3'E. January 29, 1959, 2100 hrs. Hand and ice axe from thin ice at surface. *Pleuragramma antarcticum* (3).

STATION MM-29-3: Same locality as above. January 30, 1959, 1900 hrs. Hand and ice axe in thin ice at surface. *Pleuragramma antarcticum* (1).

STATION MM-30: Just south of Hut Point, Ross Island. Lat. 77°51'S., Long. 166°38'E. November 9, 1959. Meter plankton net hung 20 ft. below surface. *Gymnodraco acuticeps* (1).

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ERYTHROCYTE COUNTS AND HEMOGLOBIN DETERMINATIONS FOR TWO ANTARCTIC NOTOTHENIID FISHES

By James C. Tyler

While engaged in marine biological collecting in the Antarctic for Stanford University aboard the U.S.S. *Edisto* during Deep Freeze IV, the writer had the opportunity to examine blood samples from specimens of two species of fish, *Trematomus borchgrevinki* and *Notothenia larsoni*, of the family Nototheniidae. Erythrocyte counts and hemoglobin determinations were made on these samples in an effort to ascertain whether these poikilothermal animals, living in perpetually frigid and highly oxygenated waters, possess smaller quantities of red blood cells and hemoglobin than is normal for other fish.

The blood of Antarctic fishes is of particular interest, for it has been reported that many species of the Antarctic fish family Chaenichthyidae possess neither erythrocytes nor hemoglobin and are without any other blood pigment (Ruud, 1954; 1958). A recent Russian paper (Martsinkevitch, 1958) casts some doubt on the total absence of erythrocytes and hemoglobin in the Chaenichthyidae. Martsinkevitch has shown that, due to the fragility of the erythrocytes, the smears made by Ruud and likewise by himself do not show erythrocytes, but that the blood vessels in histological sections of preserved visceral organs do show the presence of a very small number of erythrocytes. It should be noted that Martsinkevitch used fresh blood from seven species of Chaenichthyidae, but that his material did not include the one species from which Ruud obtained fresh blood. In any case, it is clear that all the presently studied species of this family obtain their oxygen by simple dissolution in the blood plasma and that if any erythrocytes and hemoglobin are present they occur only in functionally insignificant quantities.

The possibility exists that there are "white blooded" species, or at

least species with a reduced amount of erythrocytes and hemoglobin, in the several other families of Antarctic fishes. The writer was able to examine this possibility when four specimens, six to ten inches long, of *Trematomus borchgrevinki* were caught in surface fish traps, at different times during a period of several days, in the Weddell Sea just off the edge of the continental ice shelf at Ellsworth IGY Station. Each specimen was placed in a bucket of iced sea water while a small syringe was rinsed in sodium citrate, leaving a slight surface film of the anticoagulant in the barrel. Within a few minutes after capture, the sample was drawn from the living specimen by direct extraction from the heart. From each of the four specimens about one cc. of blood was obtained. For erythrocytes, 160 squares were counted on a Levy-Hausser hemocytometer for the single sample from each fish. The values in millions/cmm. were 0.70, 0.69, 0.80, and 0.66. For the determination of hemoglobin quantity, a one to ten dilution ratio was used with a Haden-Hausser clinical model hemoglobinometer. Expressed in grams of hemoglobin/100 cc. of blood, the determinations for the four fish, in respective order of erythrocyte values, were 3.5, 3.5, 4.0, and 3.5. The round erythrocytes had a diameter of about 11 microns.

Only one other species of Antarctic fish was taken from which adequate blood samples could be extracted. These specimens were *Notothenia larsoni*, taken off Victor Hugo Island on the west coast of the Palmer Peninsula in a bottom trawl at 71 fathoms. Blood was extracted from four specimens, five to eight inches in length, but the relatively small volume of the individual samples made it advantageous to pool the blood of two specimens in order to secure an easily analyzable quantity. Using the techniques previously mentioned, the two pooled blood samples yielded erythrocyte counts of 0.38 and 0.39 million/cmm. and had hemoglobin contents of 3.5 grams/100 cc. of blood in each instance. The erythrocytes were slightly oval, with the long diameter about 14 microns.

Both of the two species of Nototheniidae possess fewer erythrocytes and less hemoglobin than is normal for other teleost fishes, though they are far from being in the class of the "white blooded" Chaenichthyidae. Such small quantities of erythrocytes and hemoglobin as were found in these two nototheniids are not at all unusual among cyclostomes and elasmobranchs, but among the higher fishes erythrocyte counts of less than even one million/cmm. with hemoglobin content less than 4 grams/100 cc. are rather uncommon (Babudieri, 1930; Kisch, 1949; 1951; Wintrobe, 1934). For teleosts, erythrocyte counts between one and two million/cmm. and hemoglobin concentrations of seven to twelve grams/100 cc. would be considered normal. Thus the two nototheniids here discussed are intermediate between the great majority of teleosts, with quantities of erythrocytes and hemoglobin as noted above, and the Chaenichthyidae, with erythrocytes and hemoglobin either absent or present in only minute quantities.

Many more species of Antarctic fishes will have to be examined before it can be determined whether there is a tendency among them for reduction in erythrocytes and hemoglobin. The information previously published on the Chaenichthyidae and the data here presented would indicate a strong possibility that such may be true.

ACKNOWLEDGEMENTS

This study was supported by National Science Foundation Grant NSF G-6328 under the direction of Dr. Donald E. Wohlschlag, Stanford University, whose assistance throughout the entire program I wish to acknowledge. My thanks are also due to Dr. George S. Myers for his comments on the paper.

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A BRAZILIAN PIKE-CHARACID, BOULENGERELLA LATERISTRIGA, REDISCOVERED IN THE RIO NEGRO

By George S. Myers and Stanley H. Weitzman

When Alfred Russel Wallace travelled on the Amazon and Rio Negro in 1848-1852, he made an extensive collection of Rio Negro fishes, together with notes and field sketches of many of them (Wallace, 1853). The loss of all his Brazilian collections when his ship burned at sea (Wallace himself was saved by the merest chance), was most unfortunate for ichthyology. Luckily, he did save his notes and drawings and amongst them was a sketch of the fish here redescribed. However, the drawing was identified (by Regan, 1905) only after the species had been described by Boulenger in 1895. The unique holotype collected by J. C. Antony in Manaus, and the Wallace drawing, both in the British Museum, represent all that has been known of the species except the original brief description by Boulenger.

The species has been listed several times, and became the type of the new genus *Boulengerella* Eigenmann in 1903, based upon the relatively unimportant character of the incomplete lateral line. This name, for purely nomenclatural reasons (Myers, 1950) became established as the generic name of all the pike-characids. In a review based upon four specimens of the genus, Schultz (1950) has synonymized the species with *Boulengerella maculata*, a species from which it differs in several ways.

Boulengerella lateristriga (Boulenger)
Figure 1

Xiphostoma lateristriga Boulenger, 1895, p. 449 (original description; type

locality: Manaus; holotype in British Museum).—Regan, 1905, p. 190 (Wallace drawing from Rio Negro).

Boulengerella lateristriga Eigenmann, 1910, p. 446 (name only).—Fowler, 1950, p. 328 (name only).

Boulengerella maculatum Schultz, 1950, p. 54 (in part; not of Cuvier and Valenciennes).

Two examples, SU 16285, 221.0 and 147.0 mm. in standard length. Collected by the late Dr. Carl Ternetz on February 14, 1925, on a sandbank at the Brazilian-Colombian border, on the right (west) bank of the Rio Negro, opposite (northwest of) Cucuhy (now called Cucui or Cucuy). The locality is approximately at Lat. 1°11'N., Long. 66°50'W.

In the description below, counts and measurements for the longer specimen are given first, and those of the shorter specimen in parentheses. All measurements are in millimeters.

COUNTS.—Dorsal rays ii,8 (ii,8 in smaller example); anal rays ii,9 (iii,8); pectoral i,19 (i,19); pelvic i,7 (i,7); caudal 10/9 (damaged). Adipose fin present. Scales in a lateral series 79 (78); perforated lateral line scales 23 on the left side, 20 on the right side (14 on the left side, 15 on the right side); predorsal scales 63 (62); scales between posterior end of dorsal fin base and adipose fin 9 (9); scale rows between dorsal fin base and pelvic fin 12 (12). Gill rakers 9 + 14 (10 + 16).

MEASUREMENTS.—Snout tip to dorsal fin origin 175.0 (117.0); snout tip to adipose fin origin 204.0 (136.0); snout tip to anal fin origin 182.0 (120.0); dorsal fin origin to origin of adipose fin 30.0 (20.0); head 73.0 (54.0); length of mouth ?—gape damaged (25.5); least width of bony interorbital 14.5 (9.0); eye diameter 7.5 (5.4); greatest depth 26.0 (17.5); least depth of caudal peduncle 14.5 (9.0).

COLOR IN ALCOHOL.—The color description is of the larger specimen. The general tone of the fish is brownish, the fresh specimen (now preserved for 35 years and somewhat faded) having been notably darker and browner than fresh specimens of either *Boulengerella lucius* or *B. maculata*. A narrow dark brown lateral stripe extends from the central posterior border of the eye, across the elongate joint between the great orbital bone (apparently the combined third and fourth infraorbital) and the fifth infraorbital bone. It continues across the upper part of the opercular bone and along the body to about the midbase of the upper caudal fin lobe. A second dark brown stripe begins at the inferior border of the eye and extends across the midregion of the great orbital bone and the lower portion of the opercular bone. As it continues along the body, about two scale rows above the pelvic fin, the stripe progressively becomes fainter until over the midbelly region where it becomes indistinct. This stripe again becomes darker on the caudal peduncle in the larger specimen. Between these two lines the body is silvery gray, becoming darker on the caudal peduncle. Below the second stripe, the belly is silvery. Back brown, fading towards the upper narrow, dark brown, lateral stripe. Each scale of the back with a central silvery area producing about six rows of silvery spots on each side. Top of the head medium brown. Opercle, orbital bones and lower jaws silvery except between the two stripes where the opercle and great orbital are silvery brown. Just above the teeth of the upper jaw there is a somewhat indistinct brown stripe. The caudal fin, now damaged, had a pattern of dark brown pigment like that shown in the figure; the rest of the fin was dusky hyaline. Pectoral fins hyaline except for a light brown blotch a little before the middle of the anterior three or four rays, and another indistinct spot on the distal three fourths of the first to third rays. This color is the same on both pectoral fins. Pelvic fin hyaline except for a faint blotch on the distal two thirds of the fourth through fifth fin rays. Dorsal and anal fins hyaline except for the brown pigmentation shown in the figure.

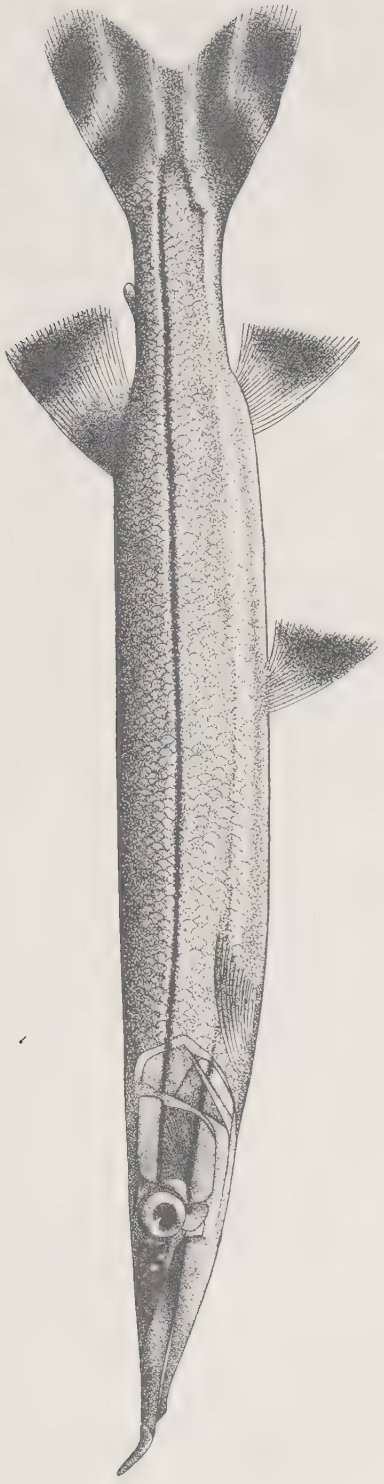

Fig. 1. *Boulengerella lateristriga* (Boulenger), SU 16285. Standard length 221.0 mm. Drawn by Mary Wallach.

NOTES ON THE FIGURE.—The accompanying illustration of *Boulengerella lateristriga*, done over 25 years ago by Mary Wallach, shows the general appearance of this fish quite well. However, it is not entirely accurate with regard to scale pattern or fin counts, and the dorsal fin rays are somewhat too long. The snout length is a bit too short. The snout and lower jaw of the specimen from which the illustration was taken (our larger example) has been damaged (together with the left eye and certain areas on the body indicated by regenerated scales) during the life of the fish. These injuries had healed but the lower jaw is somewhat bent and the upper jaw and snout are slightly misaligned and perhaps a little shorter than they would normally have been. In attempting to reconstruct the snout for the illustration the artist apparently shortened it even more. The specimen is a little faded, for the color description above, taken in 1960, differs somewhat from that shown in the illustration. The specimen now has lighter pectoral and pelvic fins.

COMPARISONS.—*Boulengerella lateristriga* is closely related to *B. maculata*. Like the latter it has an incomplete lateral line and the dorsal fin located over the anal fin. *Boulengerella lucius* has the dorsal origin on a vertical between the pelvic fins and the anal fin. It has a complete lateral line. Specimens of *B. lateristriga* at hand differ from those of *B. maculata* in having 62 to 63 predorsal scales instead of 78 to 89; 78 to 79 scales in a lateral series instead of 82 to 91; 12 scale rows between the anterior base of the dorsal fin and the anal fin instead of 15; and the dorsal fin, when depressed, fails to reach the adipose fin instead of reaching or passing it.

In color pattern, specimens of *Boulengerella maculata* have an upper dark brown line along the articulation between the great infraorbital and the fifth infraorbital bone. However, they lack the narrow dark brown line at all other points. They do not have rows of silvery spots on the back, having instead a uniform tan to brown back. One example of *B. maculata* from Peru (SU 34986) has a series of brownish blotches about the diameter of its pupil just below the dark pigment of the back. In the larger specimens (and perhaps also in more faded specimens) the spots or blotches seem to be placed rather irregularly over the sides; they have a diameter about half that of the pupil. Schultz (1950, p. 50) reported some spots as large as the eye. Both specimens of *B. lateristriga* lack spots.

Specimens of *Boulengerella maculata* examined: SU 34985, one, 261.0 mm., SL, Peru, Pevas District, Río Ampiyacu, W. G. Scherer, March 9, 1936; SU 34986, one, 155.0 mm., Peru, Pevas District, Río Ampiyacu, W. G. Scherer, 1936 or 1937; SU 53848, one, 172.0 mm., Peru, Iquitos, W. R. Allen, 1920; SU 53849, two, 269.0-270.0 mm., Brazil, State of Pará, Santarém market, Dr. Carl Ternetz, November, 1924; SU 53850, one, 147.5 mm., Peru, Pevas District, Chancho Caño, W. G. Scherer, November 11, 1939; SU 53851, one, 155.0 mm., Peru, Pevas District, Chancho Caño, W. G. Scherer, November 11, 1939; SU 53852, one, 242.0 mm., Peru, Río Ampiyacu, W. G. Scherer, August 20, 1940.

NOTE ON THE NAMES *HYDROCYNUS* AND *BOULENGERELLA*

The generic (and subfamilial) name of the pike-characids has been in dispute. The senior author (Myers, 1950) has shown that the generic name *Hydrocyon* Cuvier 1819 is merely an emendation of (or substitute for) *Hydrocynus* Cuvier 1817, and cannot be used under the International Rules. However, Cuvier's name has been almost uniformly applied to the African tigerfishes for 140 years, and in order to preserve this usage, without doing violence to the Rules, the senior author considered that Agassiz had

settled the application of *Hydrocynus* (or *Hydrocyon*) by referring all of its Cuvierian species to other genera in 1829.

Travassos (1952) preferred to apply the Rules literally but without regard for nomenclatural stability. He has pointed out that Agassiz' act is not recognized as a valid restriction under the present Rules, and that the first valid type designation for *Hydrocynus* was that of Eigenmann, made in 1910, by which act *Hydrocynus* (and *Hydrocyon*) is applied to the South American pike-characids. For the African tigerfishes, Travassos proposed the new name *Hydrocionichthys*.

We doubt that workers on African fishes will accept Travassos' nomenclature for *Hydrocynus forskahli* and its other well-known African congeners. However, neither do we care to await a decision of the International Commission on Zoological Nomenclature before publishing our paper. We therefore follow current usage of *Hydrocynus* (or *Hydrocyon*) and *Boulengerella*.

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THE SOUTH AMERICAN CHARACID GENERA EXODON, GNATHOPLAX, AND ROEBOEXODON, WITH NOTES ON THE ECOLOGY AND TAXONOMY OF CHARACID FISHES

By George S. Myers

INTRODUCTION

The South American characid fishes exist in such bewildering variety that ichthyologists who are not familiar with them frequently come to grief in their identification. Even at the present day, fish collections made in almost any part of tropical South America produce abundant new characid species and even genera. Among the exceedingly numerous smaller forms, in particular, the resemblance between species of dissimilar genera is often so great that the grossest kind of errors are commonly made, even by experienced ichthyologists, during the preliminary sorting of the specimens of any collection. Moreover, ichthyologists who attempt to work on the taxonomy of the Characidae without the advice of someone familiar with the group, and especially in the absence of large museum collections of comparative material, commonly make errors of specific and often of generic identification.

EXAMPLES OF TAXONOMIC DIFFICULTY

As examples, I refer to some experiences of my own. In recording *Probolodus heterostomus* (Myers, 1942, p. 91) I have referred to my confusion of this remarkably distinctive genus with an *"Astyanax"* in the same collection. In so doing, I almost certainly committed a second error, for I now doubt that the fish with which I first confused *Probolodus* was really an *Astyanax*. It was probably a *Deuterodon*. *Deuterodon iguape* Eigenmann (see Eigenmann, 1927, p. 346) is the dominant *Astyanax*-like characid of the Baixada Fluminense (lowlands surrounding Rio de Janeiro), and it is even doubtful that any *Astyanax* occurs in this lowland area. Young and half-grown *D. iguape* are indistinguishable from the genus *Astyanax* by either mouth form or dentition. Only older examples, above 40 or 50 mm. in standard length, begin to show the somewhat elongated jaws and flattened teeth characteristic of the genus. However, *D. iguape*, in contradistinction to all species of *Astyanax* known to me, is herbivorous, and examples of all ages will devour tiny blossoms and bits of plant material thrown into the water, which no *Astyanax* with which I have had experience will do. In fact, a species described by me, *Astyanax hastatus* (Myers, 1928, p. 87), from the vicinity of Rio, is probably based upon examples of *D. iguape*, although I have not reexamined the types (now in the U.S. National Museum) to determine this assignment with certainty. It is notable that Eigenmann and Miranda-Ribeiro each once placed examples of *D. iguape* in the genus *Astyanax* (see Eigenmann, 1927, p. 346).

PUYO'S *EXODON GUYANENSIS*

In 1948, Puyo described a new characid from French Guiana which he placed in the previously monotypic genus *Exodon*. His description and figures (see Puyo, 1949, p. 140, fig. 69 bis) showed at once that his *Exodon*

guyanensis was generically distinct from *Exodon paradoxus* Müller and Troschel (see Müller and Troschel, 1845, p. 16, pl. 4, fig. 1; Eigenmann, 1912, p. 397, pl. 60, fig. 1).

My attempts to obtain one of Puyo's three type specimens for examination failed, but his species so obviously belonged to a new genus that I prepared a short paper pointing out the distinguishing features of *E. paradoxus* and *E. guyanensis* (based on Puyo's description and figures) and proposing a new genus for the latter.

My paper had already been presented for publication when I received a contribution by Dr. Gery (1959) on *E. guyanensis*. He states that Puyo's types can be found neither in Toulouse nor in Paris and are probably lost. However, he himself collected specimens in French Guiana, which he identifies with Puyo's species, and of which he gives figures and a description. He also selects one of his examples as the neotype of *Exodon guyanensis*, and proposes for it the new genus *Roeboexodon*.

All of this is done quite properly, and would seem finally to place Puyo's species on a sound footing. The only difficulty is that Gery's fish, in my opinion, is neither specifically nor generically identical with Puyo's fish! It is, in fact, a relative of *E. guyanensis*, but represents a totally new genus and species.

There are a number of very sharp differences between the species of Puyo and Gery, and it is rather difficult to see why the latter has overlooked them. In fact, the only one of these differences especially noted by Gery is the absence in his fish of the remarkable plates of brushlike teeth described and figured by Puyo at the symphyses of the premaxillaries and dentaries. No such remarkable structures are known in any other American characid, and as Puyo both describes and figures them, it is difficult to believe that he imagined them. Gery's only reason for failure to give proper attention to these teeth appears to be his statement (in rough translation): "it appears to me improbable that two species of a group which is both low in the evolutionary scale and as specialized as the Characinae, should be found in the same biotope; it is therefore reasonable - at least provisionally - to lump the species here described with that of Puyo."

From Gery's own statements it is perfectly clear that he was not absolutely certain that his fish was the same as that of Puyo. In view of this expressed element of doubt, it is very difficult to see why Gery nevertheless proceeded to designate one of his fish as the neotype of Puyo's *guyanensis*, a step which should be taken only when identification cannot be questioned.

ECOLOGY

Moreover, Dr. Gery is evidently unaware that one of the characteristic features of the excessively rich South American characid fauna is the frequent occurrence of two or more species of similar appearance (usually of different but related genera, however) in what *appears* to be the same biotope. For example, the late Dr. Carl Ternetz collected at the same time and place two closely related but generically distinct characids (*Creagrudite maxillaris* Myers and *Creagrutus phasma* Myers) which are so closely alike that they appear to form a case of Batesian mimicry (the former being the model and the latter the mimic). I have myself collected two tiny characids near Belém do Pará, so similar that they were separable under a binocular microscope only on the closest examination, yet *all were swimming together in the same school!* One was *Hemigrammus unilineatus* Gill, the other a species of either *Pristella* or *Megalamphodus*, now being studied by Dr. Böhlke. All three genera are closely related, although separated

widely in Eigenmann's system of classification. Still another example was the collection by Dr. Ternetz of three remarkably specialized characids (*Anostomus trimaculatus* Kner, *Gnathodolus bidens* Myers, and *Synaptolaemus cingulatus* Myers and Fernandez-Yepez), all reasonably closely related but belonging to three very distinct genera, and all swimming about the same rocks at the Bifurcation of the Río Orinoco in Venezuela. The two first-mentioned forms closely resemble each other in coloration as well.

Dr. Gery also seems to make the common error of assuming that species which inhabit the same biotope must occupy the same ecological niche. No one has yet studied with care the exact ecological relationships of any group of characids or other fishes inhabiting the same area in any one of the richer streams of South America. All we have are the very rough beginnings of ecological classification (Eigenmann, 1912; Myers, 1947; Ladiges, 1951) and a few studies on the habits of individual species. The mere fact that two species are caught in the same types of places most emphatically does not mean that they inhabit the same biotope, especially when the biotopes have never been adequately studied or defined. Even less does it mean (even when two species are caught schooling together) that they necessarily eat the same food or take the same place (niche) in the ecological system of inter-species relationships.

In fact, after personally studying the habits of the fishes in those areas where fresh-water and marine fish species are most numerous, it is my opinion that the ecological inter-relations of the characids and other fishes in the larger South American streams surpass in intricacy and complexity, if not in variety, even those of the fishes on a tropical coral reef. That this is possible may be evident from the fact that the total fish fauna found within 15 or 20 kilometers radius from the city of Manaus on the Middle Rio Amazonas probably embraces over 700 species, upwards of half of them being small characids of generally similar form and appearance. The differences in habits and ecology between such numerous yet such similar species must, in many instances, be exceedingly finely drawn. Moreover, it seems probable that the physical variety of habitats (biotopes) available to these small, free-swimming fishes must not be vastly greater in variety than those in such a temperate-zone river as the Mississippi, where not more than an eighth or a tenth the number of species could be found within a similar area.

TAXONOMY

As Puyo's types are lost and Gery's examples are not available to me, I have necessarily had to depend on the published descriptions and figures. While Puyo's figures appear to be sketchily done, those he has given of other fishes known to me are characteristic and easily recognizable, and I have faith in their general trueness-to-life. However, his description of *Exodon guyanensis* is not particularly full and I have had to take certain characters from the drawings, which are not as detailed as one would like. On the other hand, Gery's drawings and description are much better, but he has failed either to figure or to describe certain necessary details, for example the shape of the end and upper border of the maxillary bone. It is therefore possible that some of the characters I give (especially those of the maxillary) are illusory, although most of the differential characters are perfectly clear. Before attempting to differentiate the Puyo and Gery species, I give a brief diagnosis of *Exodon*.

EXODON Müller and Troschel. (Type and only known species: *E. paradoxus* M. and T.). Mouth terminal, the jaws equal when the mouth is closed, the lower jaw projecting beyond the upper when the mouth is open. *Maxillary bone not slipping under the suborbital bones, its shape normal* for chara-

cids, relatively narrow, broadest at the middle and tapering toward the ends; the distal end is rounded-acuminate. Scales large, approximately 36 in lateral line to end of hypural fan. *Origin of dorsal fin* slightly *closer to base of caudal fin than to tip of snout*, almost exactly opposite the origin of the pelvic fins. Anal fin with about 20 rays (19 to 22). *Eye moderate* in size. *No large plates of brushlike teeth at premaxillary or dentary symphyses.* Premaxillary with an outer series of two or three and an inner series of six conical teeth on each side, in addition to two larger conical teeth (one on each side) at the tip of the snout, these directed straight forward. *Maxillary with approximately eight conical teeth along its entire edge, the first more strongly directed outwards than the rest. Lower jaw with an inner series of many smaller conical teeth* and *an outer series of larger conical teeth, three on each dentary, of which the second projects outward. A very large black humeral spot, much larger than the eye and much closer to the origin of the dorsal fin than to the head. A very large black tail spot*, occupying most of the caudal peduncle from below the adipose fin to the caudal base. Rio Amazonas Basin and Guiana.

GNATHOPLAX Myers, genus novum. (Type and only known species: *Exodon guyanensis* Puyo = *Gnathoplax guyanensis.*) Mouth strongly inferior, the lower jaw much shorter than the upper, even when the mouth is open. *Maxillary bone apparently not slipping under the suborbital bones* (as figured by Puyo), broad in form, narrowed towards the middle, where the *upper edge* is *excised to accommodate the very large eye*, against the lower border of which it lies, the maxillary broadened again towards the distal end, which is truncate and emarginate. *Scales* small, about 54 in lateral line, the transverse scale count being 12 above and *12 below the lateral line*, probably to the midventral line. *Origin* of *dorsal fin* placed far anteriorly, *midway between tip of snout and origin of adipose fin*, slightly behind the origin of the pelvic fins. *Eye very large*, larger than the humeral spot, its diameter almost equal to depth of caudal peduncle and contained about 3.5 times in the greatest body depth. Anal fin with 27 rays. *A plate or area at the anterior end of the premaxillaries covered with small, crowded, brushlike teeth.* At the tip of the premaxillaries, two large conical teeth (one on each side, at tip of snout) pointing forward. There is also a row of small conical teeth in the upper jaw, apparently ranged to each side of the plate. *Maxillary with an evenly spaced series of four to six large conical teeth along its free edge; apparently these are all normal in position and direction. Lower jaw (dentary), with a plate towards its anterior end covered with small, crowded, brushlike teeth.* At the tip of the lower jaw there are four larger conical teeth (two on each side) pointing forward or outward; there is also a row (or two rows?) of lateral teeth in the lower jaw. (The larger teeth are figured as of normal conical form, but with heavy bases.) A *humeral spot, smaller than the eye and placed almost as far from the head as from the origin of the dorsal fin, and a much larger spot on the tail*, beginning much behind the adipose fin, extending on the bases of the middle caudal rays. *Body* elongate, its *depth contained nearly 4.5 times in the standard length.* Rivers of French Guiana (Maroni).

ROEBOEXODON Gery. (Type and only known species: *Roeboexodon geryi* Myers, species nova, erroneously identified by Gery as *Exodon guyanensis* Puyo.) Mouth strongly inferior, the lower jaw much shorter than the upper, even when the mouth is open. *Maxillary bone slipping under the* rather broad *suborbitals* for its entire length, its shape not fully described or figured by Gery, but evidently *neither the maxillary nor the suborbital bones are excised above to accomodate the eye. Scales* small, 48 to 54 in the lateral line, the transverse scale count being 10 or 11.5 above and *7 or 8 below* (perhaps counted only to the pelvic fin base?). *Origin of dorsal*

fin midway between tip of snout and base of caudal fin. Eye of moderate size, equal to or smaller than the humeral spot, its diameter *much less* than the depth of the caudal peduncle, and contained about 4 times in the greatest body depth. Anal fin with 25 to 27 rays (III 22 to III 24). *No plate or area covered by crowded, brushlike teeth in either the upper or the lower jaw. All teeth with enormously hypertrophied conical bases, surmounted by a single small, black spine. Each premaxillary bears only four teeth,* one (largest) directed anteriorly (at snout tip), one behind it pointing laterad, one below the latter pointing downward and outward, and one pointed inward. *Except for these, the premaxillaries are said to be toothless!* Maxillaries each with seven teeth; only three of these are placed normally on the free border (one anteriorly, one towards the middle, and one towards the end of the bone); in addition there are three located and directed inward, and one (towards the proximal end) located and directed outward. Each dentary bears two anterior teeth, one behind them to the side, and four on the superior edge. A black *humeral spot equal to or somewhat larger than the eye, located much closer to the head than to the origin of the dorsal fin. A tail spot of about equal size,* placed as in the preceding genus. Body sensibly deeper than in the preceding genus, with a deeper caudal peduncle; *greatest body depth, contained about 3.25 times in standard length.* Rivers of French Guiana (Maroni Basin).

DISCUSSION

If both Puyo and Gery are correct in their figures or description, or both, especially in regard to the dentition and the shape and position of the maxillary bone, it is difficult to see how two obviously related genera of Characinae could be more distinctive. Puyo describes an elongate fish with a full dentition, in addition to the striking plates of brushlike teeth. Gery describes a smaller, more compact fish lacking such toothplates and with the remaining dentition greatly reduced, the premaxillary being toothless except for a few highly modified teeth. If the maxillaries are properly interpreted in the above account, then the differences in that bone are quite as striking and important as those of the dentition, if not more so. There are numerous other differences, in dorsal position, in eye size, in the size and location of the humeral spot, in the depth of the caudal peduncle, etc., etc.

In my opinion *Gnathoplax guyanensis* and *Roeboexodon geryi* will both eventually be found to be reasonably common members of the fish-fauna of the Maroni River, and one or both will likely prove to have a much wider range. It follows, as a matter of course, that Gery's action in designating a specimen of one species as the neotype of a very different species in another genus is both ill-advised and invalid, as is his neotype citation. The type specimen of *R. geryi* is Mus. Paris No. 59-38, a male 97.5 mm. long collected by Gery on 29 Nov., 1957, at the confluence of the Ouaqui and the Tampoc, in the Upper Maroni Basin, French Guiana. This is the specimen which Dr. Gery erroneously designated (1959, p. 347) as the neotype of *G. guyanensis* (Puyo).

NOTE ON *CREAGRUTUS PELLEGRINI* PUYO

Creagrutus pellegrini Puyo 1943 (see Puyo, 1949, p. 128), from the upper Itany and Maroni Rivers in French Guiana, has nothing to do with the genus *Creagrutus*. The scales, which are twice as large above the lateral line as in the rows below, indicate that the fish belongs to the genus *Chalceus*, a reference which Puyo's figures and his description of the dentition

support. Scales of the arrangement mentioned are known only in the South American *Chalceus* and the African *Arnoldichthys*. While my generic placement is almost certainly correct, Dr. Puyo was unable to find the inner series of small mandibular teeth, and the anal fin count (9 or 10) and transverse scale count (4/3) differ from those he himself gives for *Chalceus macrolepidotus* Cuvier. It is strange that the author did not recognize the relationship of his new fish with the latter form, a species with which he was familiar. However, internal evidence in Puyo's 1949 book leads me to believe that his ichthyological work was done at widely separated periods, and that his collections were not completely gone over and compared at any one time. Until a series of Dr. Puyo's species becomes available for examination, it seems best to recognize this fish as a doubtful species, *Chalceus pellegrini* (Puyo).

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PREFACE TO ANY FUTURE CLASSIFICATION OF THE CYPRINID FISHES OF THE GENUS BARBUS

By George S. Myers

One of the most difficult and confusing problems in the whole of ichthyology is the classification of the African, Asiatic and European fishes of the genus *Barbus* (*senso lato*). There are between 450 and 500 recognized, named "species", distributed from Central China, the Philippines, and Borneo to Spain and South Africa. Questions often come up in regard to the classification and nomenclature of the species of this large and important group, and it would appear to be useful to have on record at least one modern assessment of the present taxonomic situation in regard to the genus.

There is no doubt in the mind of any ichthyologist who has handled a large number of these fishes from all three continental areas that *Barbus*, in the wide sense, contains many phyletic lines of greater or lesser extent, and that the aggregate transcends the limit of what the majority of ichthyologists would call a single genus. Any well-founded attempt to break up such an unwieldy mass into definable genera having a real phylogenetic basis would be welcomed. However, the last treatment of the group as a whole was that of Günther (1868), which, while done with considerable critical sense and acumen, was based on scanty material and was published before most of the presently recognized forms were discovered. Moreover, even in Günther's treatment, he found it necessary to subdivide several sections of the genus purely on geographical grounds before he could handle the classification expeditiously.

The only part of the generic range in which there has been a successful attempt to divide *Barbus* into smaller genera is that area contained within the boundaries of the former Dutch East Indies. Weber and de Beaufort's (1916) classification has received well-merited praise, but it must be remembered that their treatment concerned only the species of Borneo, Sumatra, Java, and Singapore Island. Smith (1945) was able to utilize the Weber and de Beaufort system reasonably well in Thailand, but ichthyologists dealing with the forms of regions more distant from Indonesia have found difficulty in applying Weber and de Beaufort's generic criteria in their own areas. Thus, the late S. L. Hora and his numerous co-workers have generally continued to recognize *Barbus* in a wide sense throughout their numerous excellent revisional papers on the fresh-water fishes of India. Although a few writers have made some attempts to subdivide *Barbus* in China and Formosa, (*e.g.*, Oshima, 1919; 1920; Myers, 1941) these efforts have not been too well received, and both Rendahl (1928) and Nichols (1943), the two principal authorities on Chinese fresh-water fishes, have retained *Barbus* in a broad sense. In Africa, where the species are most numerous, Boulenger (1911) divided *Barbus* into several sections based primarily on scale characters, and it seems possible that these sections are of phylogenetic importance. While no important revisional work has been done on African *Barbus* as a whole since Boulenger, there have been a few regional revisions since his time (*e.g.*, Daget, 1954; Groenewald, 1958). None of the workers concerned has suggested any generic subdivision of *Barbus* in Africa. Indeed, Groenewald, in a revision of Transvaal forms, has sunk the certainly recognizable *Beirabarbus* in *Barbus*.[1] In Europe, the forms currently re-

[1]Unfortunately, neither Daget nor Groenewald seems to have been aware of the widespread occurrence of natural hybrids among the Cyprinidae, a fact now widely recognized in the North American members of this family.

ferred to *Barbus* seem to be rather alike, but in the Near East (from Anatolia and the Caucasus to the Indus River and Ethiopia) there exist forms that perhaps connect *Barbus* (*sensu stricto*) of Europe with African and Asiatic groups.

So far as species are concerned, it is clearly evident that good revisional work, done on a sufficiently wide geographical scale, will reduce the number of species and demonstrate the existence of many polytypic species, each composed of a number of allopatric subspecies or races. This is especially true in Africa. However, the existence of large numbers of perfectly good sympatric species is also evident, and the writer's guess is that 200 or more valid species of *Barbus* (*sensu lato*) exist. There is also no doubt that some good species still remain to be discovered.

In dealing with a monstrous aggregation such as this, it seems quite possible that no one will ever have the time and facilities to monograph the group *in toto*, and other methods of dealing with it must be found. What is primarily needed is a first-class revision, based on penetrating study of both external and internal anatomy, of the main phylogenetic lines within the "genus", a study which could be made by a dedicated investigator who had access to reasonably complete collections of both the Eurasian and the African forms. It is doubtful that the combined collections of museums in America would provide the necessary material, but those of Western Europe would do so. Little attention need be paid at first to unscrambling all the species in such an investigation, but it is only in the light of such a comprehensive study of the "genus" that the natural groups small enough for detailed monographic studies of the included species can be recognized and delimited.

There are, of course, many pitfalls in the way of an investigator of the phyletic lines in such a large and rapidly evolving group as this one. Evolution has proceeded at widely different rates in different areas and situations, and organic differentiation has not occurred for the benefit of those who like well-defined categories. For example, from a single, still-existing species of Bornean *Barbus* (*Puntius*), there has rapidly evolved the remarkable and unique series of endemic genera and species of Lake Lanao in the Philippines, some of which do not fit into the generic system of Weber and de Beaufort (see Herre, 1933; Myers, 1958). In a similar way, but on a far grander scale, the entrance of Asiatic *Barbus* into the African continent late in the Cenozoic clearly produced an evolutionary explosion which changed the face of the African fish fauna and provided Africa with more species of *Barbus* than all of Eurasia (see Myers, 1938). The number of invading species was probably not very large, and in their rapid evolution in Africa there has evidently been much parallelism with (and convergence towards) the Asiatic phyletic lines, which have inhabited their territory for a much longer period of geological time. Thus, it is not only possible but probable that the same superficial characters have been separately evolved in Africa as well as Asia, and that some species in Africa which resemble Asiatic forms may have no direct relationship to them. To use the Lanao *Barbus* again for illustration, some of them more closely resemble African species than anything in Asia, yet any direct relationship is out of the question. It is, therefore, evident that pronouncements regarding the classification of generic segregates of the *Barbus* group, made on the basis of mere external comparison of a relatively small percentage of the species, are not likely to be of much value, especially if they are made without careful interpretation of the complicated matters of dispersal and evolution.

Under present conditions, purely nomenclatural questions arising in connection with *Barbus* may be vexing but are inevitable. Persons dealing with the Indonesian and Siamese faunas have tended to use the generic nomenclature of Weber and de Beaufort, while workers in the vastly greater general

range of the genus have adhered to the inclusive term *Barbus*. Ichthyologists usually recognize the problem for what it is, and several who have used the Weber and de Beaufort system for Malayan species see no difficulty in reverting to the broader usage of *Barbus* for species in other areas. The only difficulty lies in providing a "standard" nomenclature for the use of non-ichthyologists who may require it. In any such event, the only obvious nomenclatural course which does not involve assuming more knowledge than we have, is to use the name *Barbus* in its broader sense for all the species. In the majority of questionable individual cases all that is involved is the substitution of *Barbus* for *Puntius* or *Labeobarbus* (= *Tor*) of the Weber and de Beaufort system.

Recently there has appeared in a popular aquarium magazine an article by L. P. Schultz (1957) which seems to have been published principally to uphold its author's ideas on aquarium fish nomenclature. He claims to have worked on the *Barbus* of Europe, Asia and Africa, states that *Barbus* is not found in tropical Africa or southern Asia, and refers several African species to the Asiatic genus *Puntius*, mostly on the superficial characteristic of the number of barbels.[2] Where he would place numerous African and Asiatic species that are obviously not *Puntius*, *Capoeta*, *Barbodes* or *Barbus* (in his restricted sense) he does not say. Nor does he give a reference to any scientific paper in which his presumably extensive tri-continental revisional studies or evaluations of characters are published. It would seem almost as if the author were unaware of the extent of the evolutionary problems involved, especially in regard to the numerous and confusing phyletic lines that must be patiently untangled before anyone can assert that he has a key to generic differentiation within what has been called *Barbus*. For the present, the writer believes that Schultz' conclusions are, to say the least, premature, and require the support of much more extensive and prolonged anatomical and phylogenetic research before they can be accepted. It remains to be pointed out only that his nomenclatural findings are not always trustworthy. Without carefully reading the International Rules, he has (with others) assumed that *Cyprinus puntio* is the type of *Puntius* by the rule of absolute tautonymy. *Puntius* and *puntio* are spelled differently and the cited rule does not apply. Therefore, the type of *Puntius* is *Cyprinus sophore* Hamilton, by the subsequent, unequivocal designation of Bleeker, in his *Atlas Ichthyologique*, 1863.

[This seems an appropriate place to point out that the name *Barbus stedmanensis* proposed by Annandale (*vice* Boulenger) for an endemic species from the Inlé Lake, Burma (see Annandale, 1918, p. 47) formerly called *Barbus compressus* Boulenger (a preoccupied name), is antedated by, and is a synonym of, *Barbus compressiformis* Cockerell (1913, p. 133) which was also proposed to replace *B. compressus* Boulenger (*nec* Day).]

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FURTHER NOTES ON CHARACID FOSSILS

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Two papers on fossil characids had not been seen when my paper on French fish fossils (Weitzman, 1960) went to press. Although these papers in no way affect my conclusions, they are cited here, with a few notes, to make the record more complete. A new genus and species, *Procharax minor*, was described by da Silva Santos and Travassos (1956), and a new species, *Lignobrycon altus*, by da Silva Santos (1946). Both species are from the "Lower Tertiary" of Nova York (Nova Iorque), Pastos Bons, State of Maranhão, Brazil.

Lignobrycon altus was later transferred tentatively to the genus *Triportheus* by da Silva Santos and Travassos (1956), to be consistent with their treatment of *Lignobrycon* in Travassos and da Silva Santos (1955). The status of *Triportheus altus* still remains in question. The unique type is largely headless. Although the critical region of the Weberian apparatus appears to be preserved, da Silva Santos makes no mention of the Weberian apparatus; it would be most useful to have its presence or absence determined.

Procharax minor is apparently related to the Recent characid genera *Charax* and *Roeboides*. Da Silva Santos and Travassos (1956) note that *Procharax* suggests relationship with *Prohydrocyon* and *Procharacinus* (Piton, 1938) only in the long, pointed teeth. However, since it is very doubtful that *Prohydrocyon* and *Procharacinus* are characids (Weitzman, 1960), it seems to me that the resemblance is coincidental, and hardly indicative of relationship.

Da Silva Santos and Travassos also take the fact that these genera *Procharax*, *Procharacinus* and *Prohydrocyon*, all have elongate, conic teeth as evidence that the original type of teeth in characids was of this kind. However, in all probability *Procharacinus* and *Prohydrocyon* are not characids but thaumaturids, and *Procharax* most closely resembles the Recent characid genera *Charax* and *Roeboides*.

Myers (1958), using another approach, states that the phylogeny to be discerned from Recent characids suggests to him that multicuspid teeth are primitive for characids.

Further remarks on the subject will have to await discovery of primitive fossil characids, as well as additional study of the morphology and relationships of Recent characids.

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FURTHER NOTES ON THE RELATIONSHIPS AND CLASSIFICATION OF THE SOUTH AMERICAN CHARACID FISHES OF THE SUBFAMILY GASTEROPELECINAE

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INTRODUCTION

While preparing a work on the osteology of a member of the characid genus *Brycon*, and collecting data for a definition of the family Characidae and the subfamily Characinae (Weitzman, 1960b), I have reexamined members of the subfamily Gasteropelecinae. The additional information acquired has altered somewhat my former views (Weitzman, 1954, pp. 227-231) about the origin of these highly modified fishes. The subfamily Gasteropelecinae was not formally defined in my earlier paper, primarily because at that time not enough information was available to compare it adequately with other characids. Definitions and diagnoses of this subfamily and its tribes and genera are presented here, and the phylogenetic significance of the few additional important characters I have found in these groups since 1954, is discussed in the notes which follow. In addition, synonymies and a key to the genera and species are presented along with photographs of all but one of the recognized species. All but two of the photographs are from live fishes, and all are pictures of adult specimens. No photograph of *Gasteropelecus levis* Eigenmann is included, as the only available specimens of this species are in too poor condition to make suitable photographs. The species apparently looks very much like *Gasteropelecus sternicla* Linnaeus. The key is mostly extracted from Weitzman (1954), and it includes both internal and external morphological criteria. However, the species can be identified from the key by use of the external characters only. The key to the members of the genus *Gasteropelecus* must be considered tentative, for the reasons given in my 1954 paper (pp. 234-239). The synonymies are selected; they are based primarily on the works of ichthyologists. Many citations to names appearing in the aquarium literature have thus been omitted; however, several such references can be found in Holly, Meinken and Rachow (1934-).

The findings presented here contribute basically to conclusions presented in the paper following (Weitzman, 1960a) on the relationships of the genus *Triportheus*.

Subfamily GASTEROPELECINAE Eigenmann, 1910

DIAGNOSIS.—The frontal bone is longitudinally corrugated and bears a strong longitudinal ridge. The supratemporal (=extrascapular or tabular) is firmly articulated to the cranium by an immovable syndesmotic joint. The median orbitosphenoid is reduced to a narrow, strutlike Y- or V-shaped bone. The posttemporal fossae, one on each side, are small areas between the greatly expanded epiotics and the supratemporals of each side. Each posterior vertical semicircular canal extends horizontally to reach almost to its respective lateral surface of the cranium. Apparently the posttemporal and supracleithrum are fused into a single bone. The postcleithra

are absent. The lateral wing of the cleithrum is reduced to a low ridge. The anterior portion of the cleithrum is greatly elongated, reaching the anterior edge of the urohyal, and, together with the cleithrum from the other side, form the floor of the branchial region. The coracoids of each side are greatly expanded and are fused into a single fan-shaped, corrugated median bone. The pelvic fins and associated bones are minute, and the flattened sides of the pelvic bones face each other.

Examination of the osteology of over 81 genera and 105 species distributed in all the major subfamilies of characids indicates that any one of the above characters will distinguish gasteropelecins from all other characids. The following additional characters will help define the Gasteropelecinae.

The lower facial bones are elongate and thrust forward so that the joint between the articular and quadrate is at a level anterior to the eye. The jaws are almost vertical. The posttemporal fossae of each side are shallow excavations in the region common to the epiotic, prootic, and pterotic. The two ventral diverging lamellae of the median ethmoid, present in the Characinae, are absent. The subfamily Characinae as here delimited contains many of Eigenmann's subfamilies of the family Characidae.[1] A median rhinosphenoid, present in many members of the Characinae, is absent. The frontal and parietal fontanels are absent in adults. The frontal is sometimes excluded from contact with the pterotic by the sphenotic (genera *Carnegiella* and *Gasteropelecus*). In *Thoracocharax* the pterotic of each side has an anterior extension that contacts its respective frontal. Toothed dermopalatines (or anterior extensions of the paired ectopterygoids) are absent. The ectopterygoid is well developed, accompanying the length of the mesopterygoid, but neither does it necessarily contact the quadrate nor is it movably articulated with the quadrate. Teeth are absent on the ectopterygoids and mesopterygoids. A foramen is always present between the quadrate and the metapterygoid. Each symplectic is quite small, never almost equaling the length of its associated hyomandibular. The paired dentaries are always toothed, the teeth being unicuspid or multicuspid and in one row with a small row of "replacement" teeth behind. The maxillary of each side reaches the postero-inferior level of the second infraorbital bone. It is never confined to the region of the first infraorbital bone. The maxillary is toothed or not. It has a uniserial row of one to many teeth that are almost invariably unicuspid. The premaxillary has one to two rows of uni- to multicuspid (almost invariably tricuspid) teeth. The premaxillary is immovably articulated to the ethmoid by a syndesmotic joint. Seven or fewer orbital bones are present. The supraorbital bone is absent; the adnasal is always present. There are four or five branchiostegal rays present. The body is very compressed and the expanded coracoids produce a large, sharp-edged thorax. The gape does not reach the orbit, and the gill membranes are partially united to or free from each other and they are free from the isthmus. The anal fin is long, with a total of 22 to 44 rays. The dorsal fin base is relatively short to moderately long, with a total of 8 to 17 rays. An adipose fin is present or absent; the caudal fin is deeply forked, both lobes of equal length. The number of principal caudal fin rays is 10/9.

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[1]Of Eigenmann's 1910 enumeration the following subfamilies are tentatively included in the Characinae: Gymnocharacinae, Aphiocharacinae (sic), Tetragonopterinae, Diapominae, Stevardiinae, Agoniatinae Stichonodontinae, Stethaprioninae, Characinae and Acestrorhamphinae. Of Eigenmann's 1912a list (pp. 253-258) the following subfamilies are included: Aphyocharacinae, Iguanodectinae, Agoniatinae, Tetragonopterinae, Bryconinae, Stethaprioninae, Triportheinae (=Chalcininae of authors), Characininae (sic), and Acestrorhamphinae. The Characinae includes most of the members of the Cheirdontinae (Aphyocharacinae) as listed by Eigenmann in 1915. Also included are members of the Rhoadsinae and Glandulocaudinae as listed by Eigenmann and Myers (1929).

KEY TO THE GENERA AND SPECIES OF THE SUBFAMILY GASTEROPELECINAE

1a. Pelvic rays i,5, the 5 forked rays twice dichotomous; dorsal rays ii, 10-15 or iii,9-14; anal rays ii,32-42 or iii,31-41; scales between the posterior lower angle of the coracoid and the anus about 18-28; scales in a longitudinal series 19-22, each with a central circular groove and about 8-10 radial grooves; branchiostegal rays 5; premaxillary with 2 tooth rows, the outer row with 3 teeth.....*Thoracocharax*

2a. In adults the distance between the origin of the pectoral fin and the lower posterior angle of the coracoid is 2.4-2.8 in standard length; 2-3 rows of scales on anal fin; anterior rays of dorsal fin with a basal black blotch.....*T. stellatus*

2b. In adults the distance between the origin of the pectoral fin and the lower posterior angle of the coracoid is 1.8-2.0 in standard length; 5-6 rows of scales on anal fin; anterior rays of dorsal fin with a distal dark area.....*T. securis*

1b. Pelvic rays i,4 (4 forked rays) or v (*i.e.*, no forked rays), forked rays when present once dichotomous; dorsal rays ii,8-10 or iii,7-9; anal rays iii,19-33; scales between the posterior lower angle of the coracoid and the anus 6-9; scales in a longitudinal series 25-37, each without a central circular groove (rarely a small central circular groove is present); there are fewer than 8 radial grooves; branchiostegal rays 4; premaxillary with 1 or 2 tooth rows, the outer row when present with only 1 tooth.

3a. Adipose fin present; lateral line complete almost to the origin of anal fin; pelvic rays i,4; first orbital bone present; a sensory canal embedded in the pterotic bone.....*Gasteropelecus*

4a. One or more teeth present on the maxillary bone; a single tooth present or absent in the outer premaxillary tooth row; sixth orbital bone present or absent.

5a. A tooth rarely present in the outer tooth row of the premaxillary; sixth orbital bone usually absent.....*G. sternicla*

5b. One tooth present in the outer premaxillary tooth row; sixth orbital bone almost always present.....*G. maculatus*

4b. Maxillary teeth absent; a single tooth present in the outer tooth row of the premaxillary; sixth orbital bone present.....*G. levis*

3b. Adipose fin absent; lateral line of 0 to about 3 scales; pelvic rays v (rarely one of these rays once forked); first orbital bone absent; no bony sensory canal in the pterotic.....*Carnegiella*

6a. Second, third, and fifth orbital bones present; anal rays iii,30-33; maxillary teeth 4-5; pectoral fin radials fused to a single bone.....*C. myersi*

6b. Second and third orbital bones present or absent, but fifth orbital absent, only a bony lateral sensory canal tube present in region of fifth orbital; anal rays iii,19-29; maxillary teeth 1-2; 3 pectoral fin radials firmly united but not fused to a single bone.

7a. Second and third orbital bones present; thorax with wide, rather wavy dark bars extending obliquely from the coracoid keel toward the dorsal fin.

8a. Second oblique dark band divided most of its length, occurring as a solid band only where it meets the coracoid keel (in very young specimens the undivided portion is longer, approaching the condition in *C. strigata*).....*C. vesca*

8b. Second dark oblique band single for about the lower half of its length.....*C. strigata*

7b. Second and third orbital bones absent; no wide wavy bands on the thorax; it is either flecked with chromatophores or with dark, narrow, upcurved, parallel rows of chromatophores.....*C. marthae*

Tribe THORACOCHARACINI, new

DIAGNOSIS.—Pterotic bone in contact with the frontal by a narrow band of bone that extends anteriorly along the lateral border of the parietal. Five branchiostegal rays present. Number of scales in longitudinal series, 19-22. Number of scales from the posterior base of the pelvics to the posterior lower angle of the coracoid, 19-28. Pelvic fin with i,5 rays, the branched rays being twice dichotomus.

Genus *THORACOCHARAX* Fowler, 1906

Thoracocharax Fowler, 1906, p. 452 (type species: *Gasteropelecus stellatus* Kner, 1859, by original designation).

Toracocharax Fowler, 1942, p. 573 (erroneous subsequent spelling and therefore an unavailable name).

Thoracothorax Price, 1955, p. 398 (erroneous subsequent spelling and therefore an unavailable name).

DIAGNOSIS.—A latero-sensory canal present in the pterotic bone. A bony sensory canal present in the upper region of the preopercle (suprapreopercle), fused to the preopercle. Six infraorbital bones and one adnasal bone present around each eye. Lateral line curves downward to approach the origin of the anal fin. No short lateral line segment on the caudal fin. Scales along midsides each with a central circular groove and radiating grooves. Premaxillary with two rows of teeth, 3 in the outer row, 7 in the inner row. Radials of the pectoral girdle 4. Dorsal fin with ii,10-15 or iii,9-14 rays. Anal fin with ii,32-42 or iii,31-41 rays. Adipose fin present.

Thoracocharax stellatus (Kner)

Figure 1

Gasteropelecus stellatus Kner, 1859, p. 15 (original description; type locality: Rio Cujaba (=Rio Cuyabá), Brazil; type in Vienna Museum).—Günther, 1864, p. 343 (description).—Gill, 1870, p. 92 (description; Peru: Río Marañon, Río Napo).—Cope, 1872, p. 265 (Peru: Río Ampiacu).—Steindachner, 1876, p. 104 (description; Brazil: Tabatinga, Manacapurú); 1882, p. 14 (Peru: Iquitos).—Garman, 1890, p. 8 (Brazil: Coary, Rio Javary, Manacapurú, Monte Alegre, Óbidos, São Paulo (on the Amazon), Tabatinga, Teffé, Villa Bella; Paraguay).—Eigenmann and Eigenmann, 1891, p. 56 (listed; distribution).—Eigenmann and Kennedy, 1903, p. 524 (Paraguay: Laguna Pasito, Asunción).—Ridewood, 1913, p. 546 (description; anatomy).—LaMonte, 1935, p. 7 (Brazil: Rio Purús).

Gastropelecus stellatus Günther, 1864, p. 343 (description).—Boulenger, 1896, p. 36 (Brazil: Descalvados); 1898, p. 426 (Brazil: Rio Juruá).—Pellegrin, 1899, p. 157 (Venezuela: Río Upuri); 1909, p. 149 (Brazil: Teffé).

Thoracocharax stellatus Fowler, 1906, p. 452 (description).—Eigenmann, McAtee and Ward, 1907, p. 141 (Brazil: near Bahia Negra, Corumbá).—Eigenmann, 1910, p. 439 (listed).—Bertoni, 1914, p. 12 (listed).—Pearson, 1924, p. 46 (Bolivia: Lago Rogoagua=L. Rogagua, Cochuela Esperanza, Rurrenabaque).—Pozzi and Bordale, 1936, p. 434 (Argentina: Río Paraguay near Asunción, Punta Gorda, Río Uruguay near Nueva Pal-

mira, San Pedro, Río Paraná; "Río de la Plata").—Bertoni, 1939, p. 56 (listed).—Fowler, 1940, p. 91 (Bolivia: Río Chaparé at junction with Río Chimoré, Cochabamba).—Eigenmann and Allen, 1942, p. 268 (description; Peru: Yurimaguas and Río Morona).—Fowler, 1942, p. 374 (listed; distribution).—Miranda Ribeiro, 1942, p. 2 (Brazil: Matto Grosso, Barrado Tapirapés, Rio Palmas, Oriximiná, Rio Javary, Amazonas).—Pozzi, 1945, pp. 257, 271 (listed; distribution; Río de la Plata, Río Paraná, Río Uruguay, Río Paraguay, Río Carcarañá).—Fowler, 1945, p. 513 (listed; distribution).—Schultz, 1944, p. 275 (listed).—Fraser-Brunner, 1950, p. 968 (description; Peru: Río Ucayali; Brazil: Rio Jurúa, Rio Tocantins, Descalvados; Paraguay: Asunción; Argentina: Santa Fé).—Hoedeman, 1952, p. 4 (listed); 1954, p. 162 (listed).—Weitzman, 1954, p. 233 (description; Bolivia: Río Beni, Lago Rogoagua; Peru: Río Morona, Yurimaguas, Iquitos; Argentina: San Pedro).—Fraser-Brunner, 1954, p. 686 (listed).—Ringuelet and Arámburu, 1957 (listed; "Paraná-Plata").—Weitzman, 1958, p. 43 (description from life; photograph).

Thoracocharax securis (nec Filippi), Arnold and Ahl, 1936, p. 125 (description from life).

It should be noted that the figure labeled "Gasteropelecus" in Gregory and Conrad (1938, p. 334) is actually that of *Thoracocharax stellatus*.

Additional records and unrecorded specimens of *Thoracocharax stellatus* are: from Peru, collected by W. G. Scherer: SU 34515, 34516, 34517, three, 51.0-57.0 mm. SL, Tuyè Caño, Pevas, August 28, 1936; SU 34524, 34525, two, 46.0-51.5 mm., Chancho Caño, Pevas, September 14, 1936; SU 34526, 34527, two, 46.5-50.0 mm., Chancho Caño, Pevas, September, 1936; SU 34528, one, 46.5 mm., Chancho Caño, Pevas, August, 1936; SU 34529, one, 39.5 mm., Chancho Caño, February 9, 1937; SU 34530, 34531, 34532, three, 31.5-53.0 mm., Río Ampiyacu, near Pevas, March 31, 1937; SU 35173, two, 34.0-52.0 mm., Río Ampiyacu, near Pevas, 1936; SU 35174, one, 43.0 mm., Río Ampiyacu, near Pevas, August 8, 1936. Venezuela: SU 51322, two, 36.5-44.0 mm., Río Amana, 6 km. east of Santa Barbara, 35 km. west of Matarin, F. F. Bond, March 16, 1939. Colombia: SU 53625, ten, 49.0-58.0 mm., vicinity of Tres Esquinas, Caquetá Province, collected for Maurice Rakowicz, June-July, 1959. Venezuela: SU 53634, 27, 22.5-30.5 mm., Río Apuré at San Fernando de Apuré, F. F. Bond, February 16, 1938.

Thoracocharax securis (Filippi)

Figure 2

Gasteropelecus securis Filippi, 1853, p. 165 (original description; type locality: Río Napo, Peru; disposition of type unknown).—Fowler, 1913, p. 560 (Brazil: Rio Madeira).

Gasteropelecus pectorosus Garman, 1890, p. 9 (original description; Brazil: Codajáz, Lago Alexo, Óbidos, Tabatinga, Manacapurú; types in Museum Comparative Zoology, Harvard).—Eigenmann and Eigenmann, 1891, p. 57 (listed; distribution).

Gasteropelecus stellatus (nec Kner) Cope, 1870, p. 566 (Peru: Pevas); 1872, p. 206 (listed).—Fowler, 1906, p. 452 (description; Peru: Pevas).

Gastropelecus pectorosus Boulenger, 1898, p. 426 (Brazil: Rio Jurúa).

Thoracocharax pectorosus Eigenmann, 1910, p. 440 (listed).—Fowler, 1940, p. 264 (description; figure; Peru: Contamana).—Eigenmann and Allen, 1942, p. 269 (listed).—Miranda Ribeiro, 1944, p. 2 (Brazil: Rio Javary).—Fowler, 1950, p. 352 (listed; distribution).

Chalceus rhomboidalis (nec Linnaeus) DeMagalhães, 1931, p. 195 (description; natural history notes).

Thoracocharax stellatus (nec Kner) Arnold and Ahl, 1936, p. 126 (description from life).—Axelrod and Schultz, 1955, p. 265 (description from life; figure).

Toracocharax pectorosus Fowler, 1942, p. 573 (listed; distribution); 1945, p. 150 (listed; distribution).

Thoracocharax securis Fraser-Brunner, 1950, p. 970 (description; Brazil: Rio Teffé, Rio Jurúa).—Hoedeman, 1952, p. 4 (listed); 1954, p. 162 (listed).—Weitzman, 1954, p. 233 (description; Peru: Río Ampiyacu, Tuyè Caño; Brazil: Codajáz, Rio Jurúa).—Fraser-Brunner, 1954, p. 686 (listed).—Weitzman, 1958, p. 43 (description from life; photograph).

Tribe GASTEROPELECINI Eigenmann, 1910

DIAGNOSIS.—Pterotic bone excluded from contact with the frontal by the sphenotic. Four branchiostegal rays present. Number of scales in longitudinal series, 25-37. Number of scales from the posterior base of the pelvics to the posterior lower angle of the coracoid, 6-9. Pelvic fin with i,4 rays or v rays (*i.e.*, no dichotomous rays), the branched rays once dichotomous, rarely a rudimentary ray adnate to the posterior ray giving a count of i,5.

NOMENCLATURAL NOTE.—Eigenmann (1910) was the first to base a family group name, Gasteropelecinae, on the genus *Gasteropelecus*. Hoedeman (1949) was the first to propose the use of this family group name as a tribe; however, Hoedeman considered his tribe Gasteropelecini equivalent to the Gasteropelecinae as here defined (see above).

Genus *Gasteropelecus* Scopoli

Gasteropelecus Gronow, 1763, p. 135 (not accepted by International Commission of Zoological Nomenclature).

Gasteropelecus Scopoli, 1777, p. 458 (type species: no species listed but clearly based on Gronow; therefore the type by monotypy is Gronow's species, which is *Clupea sternicla* Linnaeus, 1758).

Gasteropleucus Duméril, 1806, p. 114 (erroneous subsequent spelling and therefore an unavailable name).

Gasteroplecus Rafinesque, 1815, p. 88 (erroneous subsequent spelling and therefore an unavailable name).

Gasteropelicus Fleming, 1822, p. 384 (erroneous subsequent spelling and therefore an unavailable name).

Gastropelecys Agassiz, 1846, p. 159 (an emendation, therefore taking the same type species as *Gasteropelecus* Scopoli, 1777, which is *Clupea sternicla*, Linnaeus, 1758).

Gastropelecus Günther, 1864, p. 342 (an emendation, therefore taking the same type species as *Gasteropelecus* Scopoli, 1777, which is *Clupea sternicla*, Linnaeus, 1758).

Pterodiscus (nec Pilsbry) Eigenmann, 1909, p. 12 (type species: *Pterodiscus levis* Eigenmann, 1909, by original designation).

DIAGNOSIS.—A latero-sensory canal present in the pterotic bone. A bony sensory canal (suprapreopercle) fused to the upper region of the preopercle. Six infraorbital bones and an adnasal present around each eye. Lateral line curved downward to approach the origin of the anal fin. A short lateral line segment with perforated scales present on the caudal fin. Scales along the midsides very rarely with a central circular groove. Radiating

grooves present. Number of scales in a longitudinal series 28-37. Premaxillary with 0 to 1 tooth in the outer row, inner row with 7-9 teeth. Radials of the pectoral girdle 4. Dorsal fin with ii,8-10 or iii,7-9 rays. Anal fin with iii,23-33 rays. Adipose fin present.

Gasteropelecus sternicla (Linnaeus)

Figure 3

Clupea sternicla Linnaeus, 1758, p. 319 (original description; type locality: Surinam; restricted to Paramaribo, Surinam, by Hoedeman; type description based on Gronow, 1756; holotype in British Museum [Natural History]).—Koelreuter, 1761, p. 405 (not seen).

Gasteropelecus (no specific name) Scopoli, 1777, p. 458 (description).—Duméril, 1856, pp. 454-457 (keyed; description).

Salmo gasteropelecus Pallas, 1769, p. 80 (description; figure).—Bloch, 1785, p. 165 (description; figure).—Bonnaterre, 1788, p. 170 (description; figure).—Gmelin, 1789, p. 1384 (description).—Bloch and Schneider, 1801, p. 418 (description).

Gasteropelecus argenteus Lacépède, 1803, p. 258 (description).

Gasteropelecus (no specific name) Duméril, 1806, p. 144 (description).

Salmo gasteropelicus sternicola Fleming, 1822, p. 384 (listed).

Gasteropelicus sternicla Cuvier, 1817, p. 171 (description).—Swainson, 1839, p. 290 (description).

Gasteropelecus sternicla Cuvier and Valenciennes, 1849, p. 169 (description; figure; Surinam).—Gray, 1854, p. 171 (description; Surinam; Gronow's specimen).—Kner, 1859, p. 14 (description; Brazil: Matto Grosso, Rio Guaporé).—Eigenmann and Eigenmann, 1891, p. 56 (listed; description).—Fowler, 1906, p. 452 (description; Surinam).—Eigenmann, 1910, p. 439 (listed); 1912, p. 379 (British Guiana: mud-flat below Wismar, Wismar, Mora Passage, trenches of Morawhanna, Mud Creek, Aruka River).—Arnold and Ahl, 1936, p. 124 (description from life; figure).—Fowler, 1939, p. 288 (listed).—Ihering, 1940, p. 710 (natural history note).—Eigenmann and Allen, 1942, p. 267 (Peru: Iquitos).—Fowler, 1942, p. 373 (listed; distribution).—Fraser-Brunner, 1950, p. 963 (description; relationships; British Guiana: Essequibo, Demerara River; French Guiana: Cayenne; Surinam).—Fowler, 1945, p. 150 (listed; distribution).—Boeseman, 1953, p. 21 (Surinam: Paramaribo, Wanekreek, Saramacca River, Kabelstation, Surinam River, Coropina (=Coropine) Creek, Republiek, Marowini Basin); 1954, p. 20 Surinam: Paramaribo).—Weitzman, 1954, p. 234 (discussion of relationships; British Guiana: Demerara River, Morawhanna, Aruka River, Mora Passage; Venezuela: Upata, El Callao; Peru: Yurimaguas, Iquitos).—Boeseman, 1956, p. 188 (Surinam).—Weitzman, 1958, p. 44 (description from life; relationships; photograph).—Wheeler, 1958, p. 209 (description and photograph of holotype in Gronovian collection).—Boeseman, 1960, p. 97 (Trinidad: Southern Main Road).

Gastropelecus sternicla Günther, 1864, p. 342 (description; British Guiana: Surinam, Essequibo River).—Goeldi, 1898, p. 484 (description; Brazil: "Sapopema", Ilha das Onças, Pará).—Regan, 1913, p. 281 (Peru: Río Ucayali).

Gasteropelecus sternicla (in part) Garman, 1890, p. 8 (specimens from Surinam only).—Eigenmann and Ogle, 1907, p. 30 (description; specimen from Guiana only).

Gasteropelecus stellatus (nec Kner) DeMagalhães, 1931, p. 150 (natural history notes; Brazil: Utinga, Belém).

Gasteropelecus coronatus Allen, in Eigenmann and Allen, 1942, p. 267 (original description; type locality: Río Itaya near Iquitos, Peru fig-

ure; type at California Academy of Sciences).—Fowler, 1942, p. 373 (listed; distribution).—Miranda Ribeiro, 1944, p. 1 (Peru: Pevas). —Fowler, 1945, p. 150 (listed; distribution); 1950, p. 150 (listed); distribution).—Fraser-Brunner, 1950, p. 963 (description).

Gasteropelecus sternicla sternicla Hoedeman, 1952, p. 10 (listed; Surinam: Paramaribo, Berg en Daal); 1954, p. 159 (listed).—Fraser-Brunner, 1954, p. 686 (listed).

Gasteropelecus sternicla marowini Hoedeman, 1952, p. 10 (original description; type locality: Marowini Basin, Surinam; types in Zoological Museum, Amsterdam); 1954, p. 159 (listed).

Gasteropelecus sternicla morae Hoedeman, 1952, p. 11 (original description; type locality: Mora Passage, British Guiana; type in Zoological Museum, Amsterdam); 1954, p. 159 (listed).—Fraser-Brunner, 1954, p. 686 (listed).

Gasteropelecus sternicla coronatus Hoedeman, 1952, p. 11 (listed).

Thoracothorax maculatus Price, 1955, p. 10 (Trinidad: Cedros).

Additional records of *Gasteropelecus sternicla*: SU 50282, one, 42.0 mm., swampy stream on the left bank of the Río Orteguaza, 2-3 miles above Tres Esquinas, Caquetá Province, Colombia, at 0°48'N., 75°15'W., General Thomas D. White, Colonel J. N. Reynolds, Mr. Lee Wulff and Dr. George S. Myers; SU 50615, two, 52.0-53.0 mm., muddy stream tributary to Río Caguán, 10-20 miles above junction with Río Caquetá, Caquetá Province, Colombia, at about 0°10'N., 74°05'W., General Thomas D. White, Colonel J. N. Reynolds and Mr. Lee Wulff, February 11, 1958; SU 51283, four, 31.0-37.5 mm., head of Katuma River, northwestern British Guiana, Alan M. Fletcher, April 25, 1958; SU 53149, 41, 30.0-41.0 mm., "within 2 miles of Tres Esquinas", Caquetá Province, Colombia, collected for Maurice Rakowicz, February, 1959; SU 53330, 40 (topotypes), 28.0-44.5 mm., vicinity of Zanderij Airfield, Paramaribo, Surinam, at 05°27'N., 55°12'W., General Thomas D. White, Colonel J. N. Reynolds and Mr. Lee Wulff, March 5, 1959.

Gasteropelecus maculatus Steindachner
Figure 4

Gasteropelecus maculatus Steindachner, 1879, p. 168 (original description; type locality: Río Mamoní, Panama; types in Vienna Museum).—Eigenmann and Eigenmann, 1891, p. 57 (listed; distribution).—Jordan and Evermann, 1896, p. 338 (description).—Regan, 1908, p. 173 (description).—Weitzman, 1954, p. 234 (discussion of relationships; Panama: El Capitan, Río Mamoní; Colombia: Río San Juan, Raspadura, Quibidó, Río Truandó, Girardot; Venezuela: Río Monay, 40 km. north of Trujillo, Maracaibo Basin); 1958, p. 44 (photograph).

Thoracocharax brevis Eigenmann, 1912b, p. 25 (original description; type locality: Raspadura, Colombia; type in the Chicago Natural History Museum).

Thoracocharax magdalenae Eigenmann, 1912b, p. 25 (original description; type locality: Girardot, Colombia; type in Chicago Natural History Museum).—Meek and Hildebrand, 1916, p. 288 (description; Panama: Chorrera, Río Bayano, Río Tuyra).—Eigenmann, 1920a, p. 19 (distribution); 1920c, p. 32 (distribution); 1922, p. 157 (Colombia: Girardot, Río Truandó, Quibidó, Raspadura, Río Calima).—Miles, 1947, p. 165 (description).

Thoracocharax maculatus Meek and Hildebrand, 1916, p. 288 (description; Panama: Chorrera, Río Bayano, Río Tuyra).—Eigenmann, 1920a, p. 19 (distribution); 1920b, p. 11 (distribution); 1920c, p. 13 (distribution).—Breder, 1926, p. 250 (behavior); 1927, p. 125 (growth;

food; behavior).—Starks, 1930, p. 24 (osteology of pectoral girdle).—Breder, 1937, p. 422 (behavior).—Hildebrand, 1938, p. 270 (Panama: La Jugua Hunting Club).—Axelrod and Schultz, 1955, p. 264 (description; photograph labeled as *Thoracocharax maculatus* but looks more like *Gasteropelecus sternicla*).

Thoracocharax maculatus magdalenae Schultz, 1944, p. 275 (description; Venezuela: Maracaibo Basin).

Thoracocharax maculatus maculatus Schultz, 1944, p. 276 (anal fin ray counts only).

Gasteropelecus maculatus maculatus Fraser-Brunner, 1950, p. 962 (description; figure; Colombia: Río Truandó, Río San Juan).—Hoedeman, 1952, p. 11 (discussion of relationships); 1954, p. 159 (listed).—Fraser-Brunner, 1954, p. 686 (listed).

Gasteropelecus maculatus magdalenae Fraser-Brunner, 1950, p. 962 (description; relationships).—Hoedeman, 1952, p. 13 (listed); 1954, p. 159 (listed).

Additional records of *Gasteropelecus maculatus*: SU 49507, ten, 31.0-40.0 mm., Betanci, Sinú, Córdoba, Colombia, George Dahl, January 16, 1956; SU 49508, two, 44.0-47.0 mm., Lorenzo Brook, Middle Sinú, Córdoba, Colombia, George Dahl, January 13, 1957; SU 50395, 26, 26.0-50.0 mm., Upper Río Magdalena at or near the junction of the Río Samana and Río La Miel near La Dorada, Colombia, at 5°29'N., 74°40'W., General Thomas D. White, Colonel J. N. Reynolds, February 27, 1957.

Gasteropelecus levis (Eigenmann)

Gasteropelecus sternicla (nec Linnaeus) Cope, 1870, p. 566 (listed; Brazil: Pará).

Gasteropelecus sternicla (in part) Garman, 1890, p. 8 (description; Brazil: Tabatinga, Lago Alexo, Belém do Pará, Curupira, Codajáz).—Eigenmann and Ogle, 1907, p. 30 (description; specimens from Brazil: Pará).

Pterodiscus levis Eigenmann, 1909, p. 12 (original description; type locality: Belém do Pará, Brazil; type in U. S. National Museum).—Innes, 1935, p. 134 (description from life; photograph).—Arnold and Ahl, 1936, p. 124 (description from life; figure).

Gasteropelecus levis Myers, 1940, p. 35 (correction of generic name).—Fraser-Brunner, 1950, p. 964 (description; relationships; Peru: Río Ucayali; Brazil: Manaus to Pará).—Weitzman, 1954, p. 234 (discussion of relationships; Brazil: Pará).—Fraser-Brunner, 1954, p. 686 (listed).—Weitzman, 1958, p. 44 (relationships).

Gasteropelecus laevis Fowler, 1950, p. 351 (listed; distribution).

Gasteropelecus sternicla levis Hoedeman, 1952, p. 10 (Brazil: Belém do Pará); 1954, p. 159 (listed).

Genus *CARNEGIELLA* Eigenmann, 1909

Carnegiella Eigenmann, 1909, p. 13 (type species: *Gastropelecus strigatus* Günther, 1864, by original designation).

DIAGNOSIS.—A latero-sensory canal absent in the pterotic bone. A bony sensory canal absent in the upper region of the preopercle. Infraorbital bones variously reduced, the first (anteriormost) always absent. Adnasal present. Zero to two or three perforated scales in the lateral line just behind the cleithrum. No perforated lateral line scales present on the caudal fin. Scales along the midsides very rarely with a central circular

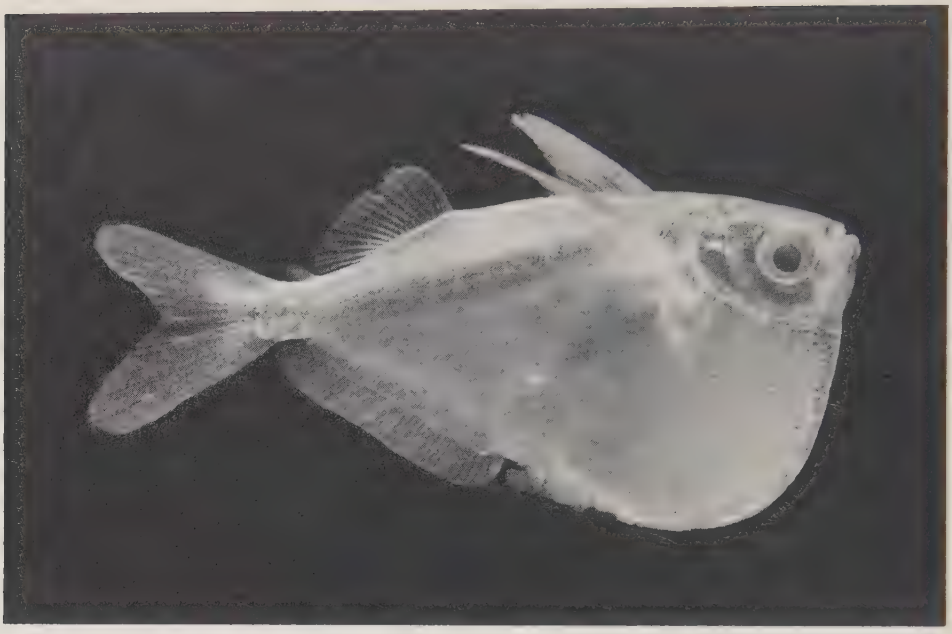

Fig. 1. *Thoracocharax stellatus* (Kner), SU 53897. Standard length 33.5 mm. Aquarium specimen.

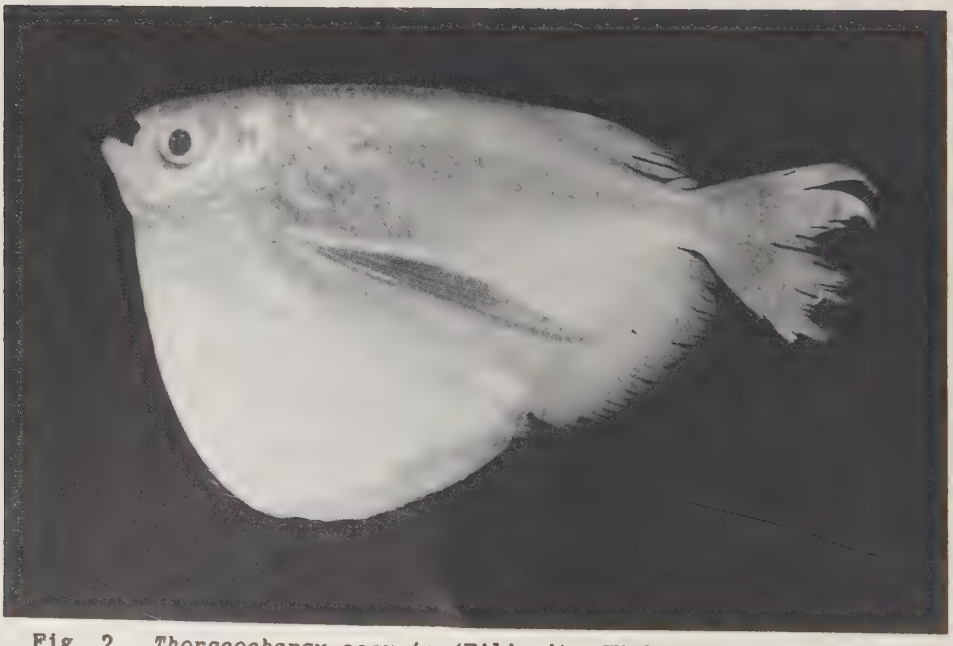

Fig. 2. *Thoracocharax securis* (Filippi), SU 34522. Standard length 68.0 mm. Peru: Pevas District, Tuyè Caño.

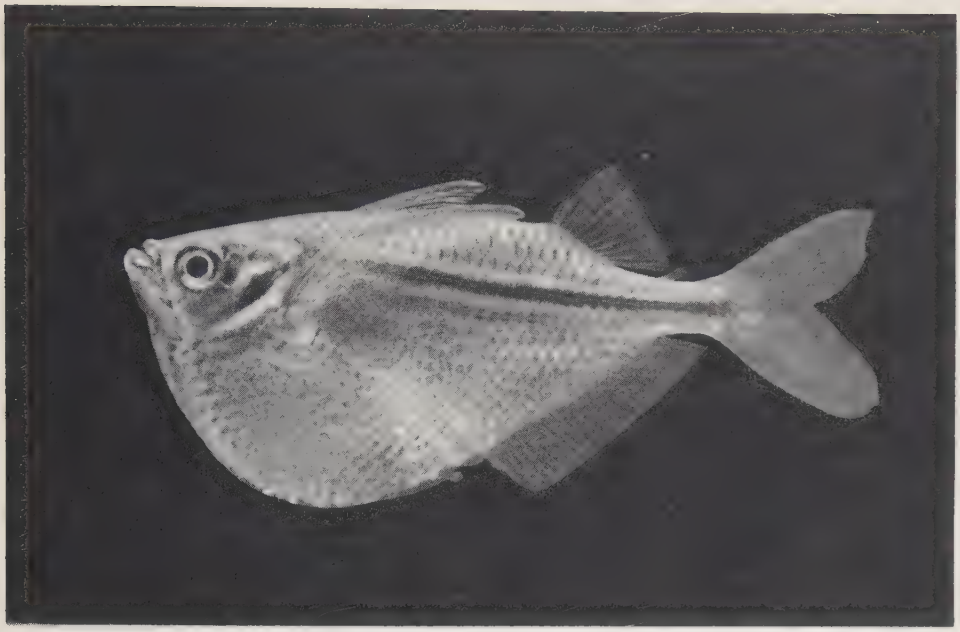

Fig. 3. *Gasteropelecus sternicla* (Linnaeus), SU 53896. Standard length 42.0 mm. Aquarium specimen.

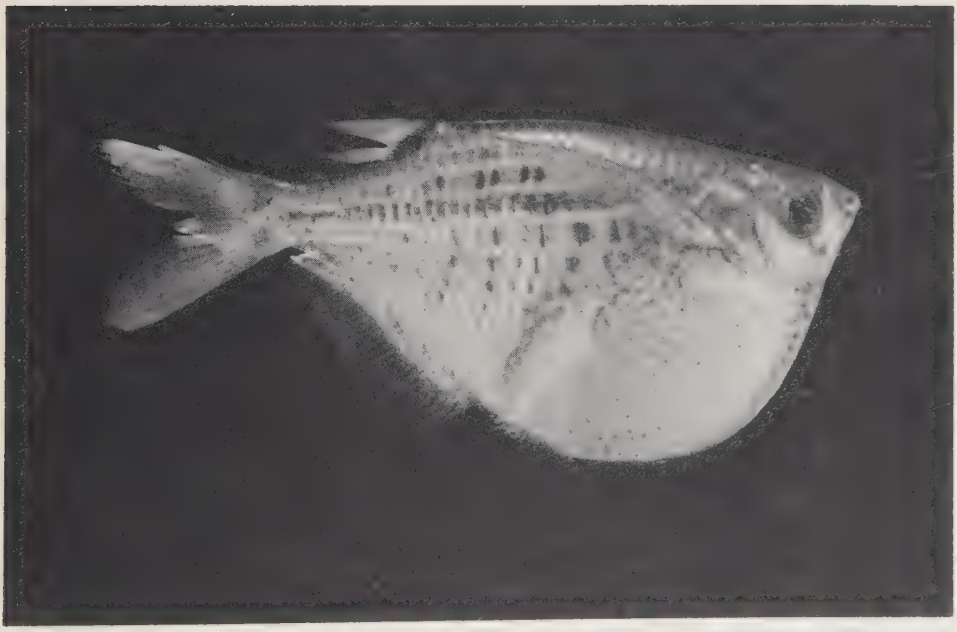

Fig. 4. *Gasteropelecus maculatus* Steindachner, SU 50395. Standard length 48.5 mm. Colombia: Río Magdalena near La Dorada.

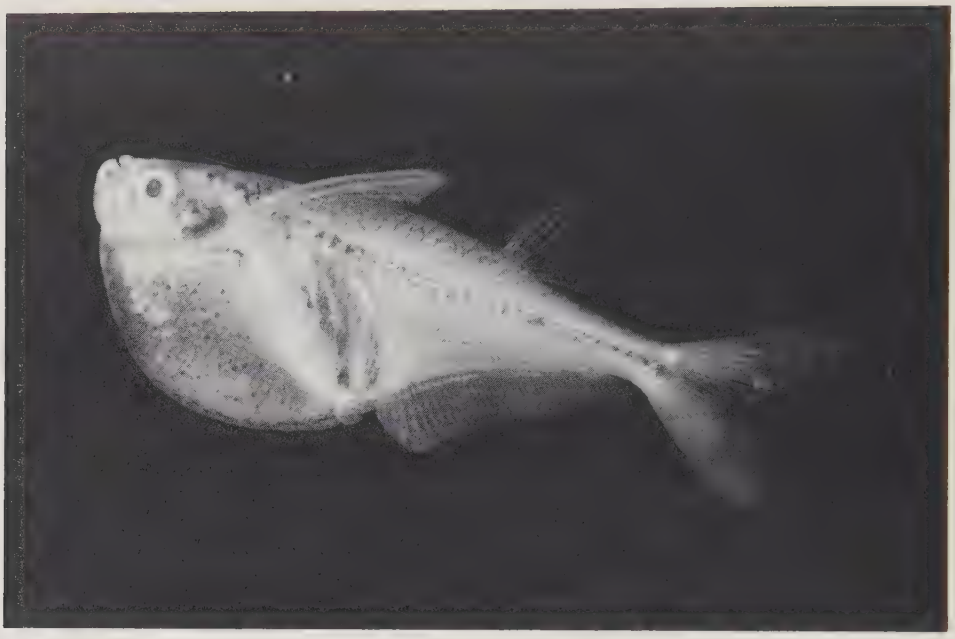

Fig. 5. *Carnegiella myersi* Fernandez-Yepez, SU 52636. Standard length 25.4 mm. Aquarium specimen.

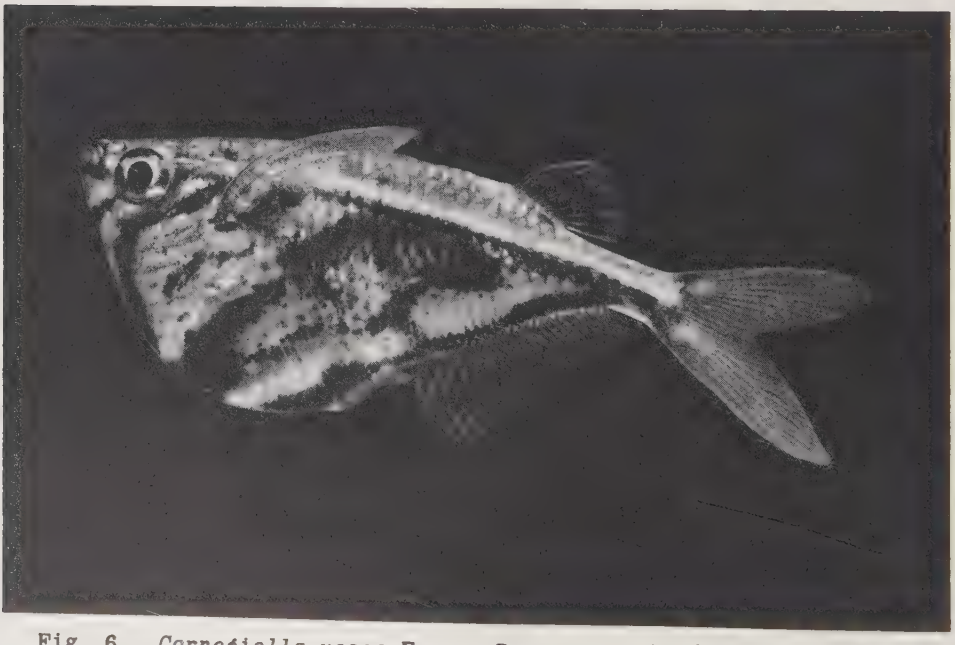

Fig. 6. *Carnegiella vesca* Fraser-Brunner. Standard length 28.0 mm. (Specimen destroyed - no SU number.)

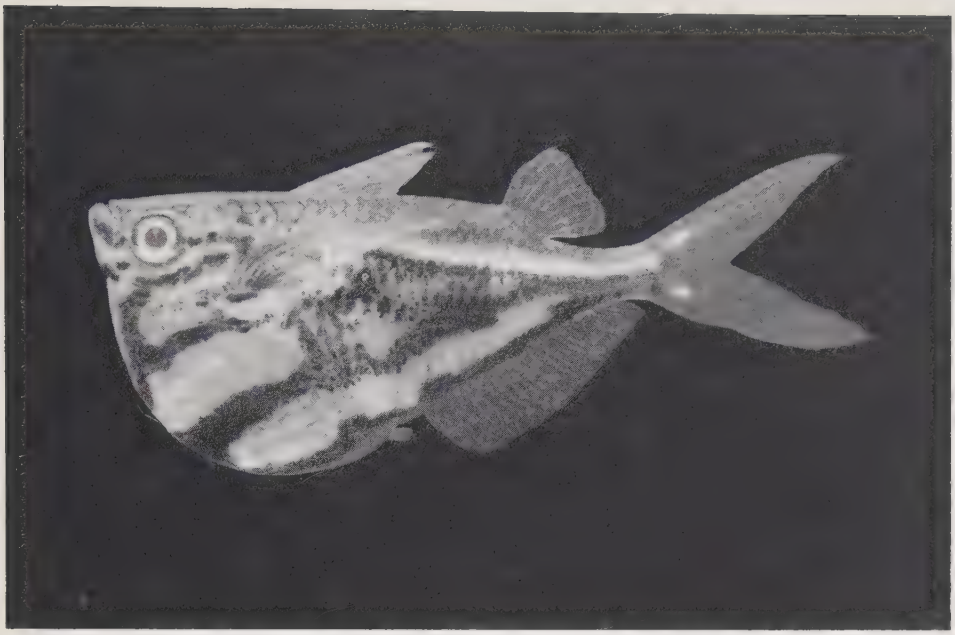

Fig. 7. *Carnegiella strigata* (Günther). Standard length 27.0 mm. (Specimen destroyed - no SU number.)

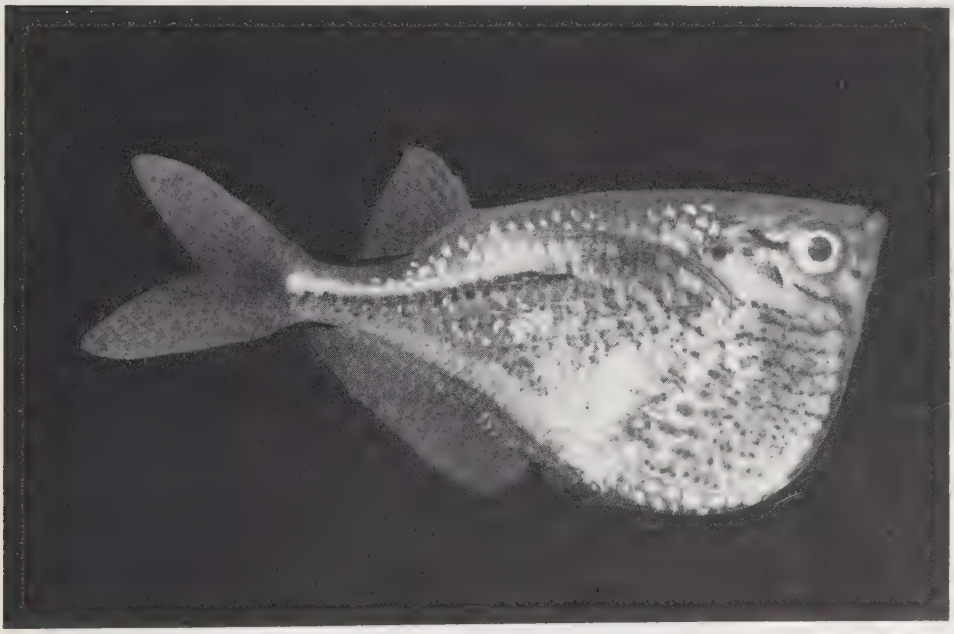

Fig. 8. *Carnegiella marthae* Myers, SU 53635. Standard length 27.5 mm. Aquarium specimen from Peru.

groove. Radiating grooves present. Number of scales in a longitudinal series 25-32. Premaxillary with no outer tooth row and the inner row with 8 to 11 teeth. Radials of the pectoral girdle 3 or fused to a single element. Dorsal fin with ii,6-8 or iii,5-7 rays. Anal fin with iii,19-33 rays. Adipose fin absent.

Fraser-Brunner (1954) placed *Carnegiella* as a subgenus of *Gasteropelecus*. At that time the only difference recognized by him between these genera was the presence of the adipose fin in *Gasteropelecus* and its absence in *Carnegiella*. In view of the number and magnitude of the characters recorded above separating *Carnegiella* and *Gasteropelecus* it seems wise to retain *Carnegiella* as a distinct genus.

Carnegiella myersi Fernandez-Yepez

Figure 5

Carnegiella myersi Fernandez-Yepez, 1950, p. 175 (original description; type locality: creek near Yurimaguas, Peru; type in Natural History Museum, Stanford University).—Fraser-Brunner, 1950, p. 964 (discussion of relationships).—Hoedeman, 1954, p. 160 (listed).—Weitzman, 1954, p. 239 (discussion of relationships; Peru: Yurimaguas); 1958, p. 45 (description from life; photograph).

Gasteropelecus myersi Fraser-Brunner, 1954, p. 686 (listed).

Carnegiella marthae (in part) Axelrod and Schultz, 1955, p. 181 (description of *C. marthae*; photograph of *C. myersi*).

Carnegiella vesca Fraser-Brunner

Figure 6

Gasteropelecus strigata (in part) Steindachner, 1876, p. 104 (description, but only of the specimen said to be most probably from Guiana).

Gasteropelecus fasciatus (in part) Garman, 1890, p. 10 (description; Brazil: Lagôa Saraçá, Codajáz).

Carnegiella strigata (nec Günther) Eigenmann, 1909, p. 13 (description; British Guiana: Maduni Creek, Gluck Island, Malali, Tumatumari, creek below Potaro Landing, Rupununi Pan); 1912, p. 378 (description; photograph; British Guiana: Maduni Creek, Gluck Island, Malali, Tumatumari, creek below Potaro Landing, Rupununi Pan, Wismar, Rockstone sandbank).—Fernandez-Yepez, 1950, p. 179 (description; figure; specimens recorded by Eigenmann, 1909 and 1912; Brazil: Codajáz).—Myers, 1950, p. 183 (discussion of relationships).—Boeseman, 1954, p. 20 (Surinam: Paramaribo).

Carnegiella strigata (in part) Eigenmann, 1910, p. 378 (listed; distribution).—Axelrod and Schultz, 1955, p. 182 (description of *C. strigata*; photograph of *C. vesca*).

Carnegiella strigatus Beebe, 1910, p. 252 (natural history notes; photograph).—Roth, 1943, p. 58 (listed).

Carnegiella strigata vesca Fraser-Brunner, 1950, p. 965 (original description; figure; type locality: Mazuruni, British Guiana; holotype in British Museum [Natural History]).—Hoedeman, 1952, p. 14 (description).—Boeseman, 1952, p. 190 (Surinam: Coropina [=Coropine] Creek, Marowini Basin); 1953, p. 20 (Surinam: Coropina [=Coropine] Creek, Vierkinderen, Laikreek, Moengo Tapeo, Wanekreek, Djaikreek, Marowini Basin); 1956, p. 188 (Surinam).

Carnegiella strigata marowini Hoedeman, 1952, p. 14 (original description; type locality: Marowini River, Surinam; holotype in Leiden Museum); 1954, p. 160 (listed).

Carnegiella strigata surinamensis Hoedeman, 1952, p. 15 (original description; type locality: Surinam Swamp about 50 km. south of Paramaribo; type in Leiden Museum); 1954, p. 160 (listed).
Carnegiella vesca Weitzman, 1954, p. 217 (osteology); p. 239 (description; relationships; British Guiana: Gluck Island, creek below Potaro Landing, Tumatumari, Rockstone, Malali, Maduni Stop-Off); 1958, p. 44 (description from life; photograph).
Gasteropelecus vesca vesca Fraser-Brunner, 1954, p. 686 (listed).
Gasteropelecus vesca surinamensis Fraser-Brunner, 1954, p. 686 (listed).

In my paper (Weitzman, 1954) on the osteology of this species I did not record radials in the pelvic fin and girdle. Reexamination of osteological preparations of this species shows that there are three radials present. Also, reexamination of the skeleton of the caudal peduncle shows that there are seven hypurals associated with the last vertebra and urostyle, not six as I stated (*loc. cit.*, 1954, p. 224). There is a small additional hypural just superior to the uppermost hypural illustrated (*loc. cit.*, p. 255, fig. 13). Placement of part of Garman's material in synonymy here follows Fernandez-Yepez (1950).

Additional records of *Carnegiella vesca*: SU 51280, two, 28.0-28.5 mm., head of Katuma River, northwestern British Guiana, Alan M. Fletcher, April 25, 1958; SU 53315, five, 25.0-29.5 mm., vicinity of Zanderij Airfield, Paramaribo, at Surinam, 05°27'N., 55°12'W., General Thomas D. White, Colonel J. N. Reynolds and Mr. Lee Wulff, March 4-5, 1959.

Carnegiella strigata (Günther)

Figure 7

Gastropelecus strigatus Günther, 1864, p. 343 (original description; type locality: originally unknown but restricted by Hoedeman, 1952 to Manaos, Brazil; types in British Museum [Natural History]).
Gasteropelecus fasciatus (in part) Garman, 1890, p. 9 (original description; type locality: [as restricted by Fernandez-Yepez] Tabatinga at the Peruvian-Brazilian border, Brazil; types in Museum Comparative Zoology, Harvard).—Eigenmann and Eigenmann, 1891, p. 57 (listed; distribution).
Gasteropelecus strigatus (in part) Steindachner, 1876, p. 104 (description; specimen from Brazil: Manacapurú).
Gasteropelecus strigatus Eigenmann and Eigenmann, 1891, p. 57 (listed; Brazil: Manacapúrú, west of Manaos).
Carnegiella strigata (in part) Eigenmann, 1910, p. 378 (listed; distribution).—Fowler, 1942, p. 374 (listed; distribution); 1945, p. 152 (listed; distribution); 1950, p. 350 (listed; distribution).—Axelrod and Schultz, 1955, p. 182 (description of *C. strigata*; photograph of *C. vesca*).
Carnegiella strigata LaMonte, 1935, p. 7 (Brazil: Rio Juruá).—Innes, 1935, p. 135 (description from life; photograph).—Arnold and Ahl, 1936, p. 124 (description from life; figure).—Eigenmann and Allen, 1942, p. 269 (Peru: Iquitos).—Fowler, 1942, p. 374 (listed; distribution).—Miranda Ribeiro, 1944, p. 2 (Brazil: Rio Javary, Manaos, Belém do Pará).—Hoedeman, 1954, p. 160 (description from life; figure).—Weitzman, 1954, p. 230 (description; Peru: Iquitos, Yurimaguas, Pevas; Brazil: Belém do Pará); 1958, p. 44 (description from life; photograph).
Carnegiella fasciata Fernandez-Yepez, 1950, p. 180 (description; figure; selection of lectotype of *Gasteropelecus fasciatus* Garman; Brazil: Tabatinga, Lagôa Saraçá; Peru: Iquitos).—Myers, 1950, p. 183 (relationships).

Carnegiella strigata fasciata Hoedeman, 1952, p. 13 (listed).
Gasteropelecus strigata strigata Fraser-Brunner, 1954, p. 686 (listed).

Additional records of *Carnegiella strigata*: SU 50624, four, 23.5-26.0 mm., small forest streams tributary to the Río Orteguaza on road from Tres Esquinas to Solano, Caquetá Province, Colombia, General Thomas D. White, Colonel J. N. Reynolds and Mr. Lee Wulff, February 12, 1958; SU 50654, five, 22.0-26.0 mm., across Río Orteguaza from Tres Esquinas, Caquetá Province, Colombia, at 0°45'N., 75°15'W., General Thomas D. White, Colonel J. N. Reynolds, Mr. Lee Wulff and Dr. George S. Myers, February 13, 1958.

Carnegiella marthae Myers

Figure 8

Carnegiella marthae Myers, 1927, p. 119 (original description; type locality: Caño de Quiribana, near Caicaro de Orinoco, Venezuela; type at California Academy of Sciences); 1934, p. 217 (description from life; behavior; Brazil: Manaos).—Innes, 1935, p. 136 (description from life; photograph).—Myers, 1942, p. 93 (Peru: Chancho Caño, Pevas).—Miranda Ribeiro, 1944, p. 3 (Peru: Yana-yacu).—Schultz, 1944, p. 275 (listed).—Fowler, 1950, p. 350 (listed; distribution).—Fernandez-Yepez, 1950, p. 177 (description; figures; Venezuela: Caño de Quiribana, near Caicaro de Orinoco, Caño de Quiribana, opposite Pan de Azucar, creek into Laguna San Rafael, near Caicaro de Orinoco).—Myers, 1950, p. 183 (discussion of relationships).—Fraser-Brunner, 1950, p. 966 (listed).—Weitzman, 1954, p. 239 (discussion of relationships; same specimens as Fernandez-Yepez, 1950); 1958, p. 45 (description from life; photograph).
Carnegiella schereri Fernandez-Yepez, 1950, p. 178 (original description; type locality: Caño del Chancho, Pevas, Peru; type in Natural History Museum, Stanford University).—Myers, 1950, p. 183 (discussion of relationships).—Weitzman, 1954, p. 239 (discussion of relationships; Peru: Chancho Caño at Pevas, Quebrada Yaquasyacu near Pevas, Río Ampiyacu, near Pevas; Brazil: Lake Hyanuary).
Carnegiella marthae schereri Hoedeman, 1954, p. 160 (listed).
Gasteropelecus marthae schereri Fraser-Brunner, 1954, p. 686 (listed).
Gasteropelecus marthae marthae Fraser-Brunner, 1954, p. 686 (listed).
Carnegiella marthae (in part) Axelrod and Schultz, 1955, p. 181 (description of *C. marthae*; photograph of *C. myersi*).

Formerly I considered *Carnegiella schereri* as a species doubtfully distinct from *C. marthae*. Recent examination of live and preserved specimens imported for the aquarium trade from Peru (SU 53635) indicates that they have a color pattern like *C. marthae*, not somewhat different as formerly thought (see the keys in Weitzman, 1954, p. 233, and Fernandez-Yepez, 1950, p. 174). In addition, anal fin ray counts in these specimens give a range of from 22 to 27, and are distributed as follows: one had 22, three had 23, eleven had 24, nineteen had 25, six had 26 and four had 27 rays. Specimens of *C. marthae* from Venezuela are recorded to have a range of 19 to 21 anal fin rays. Very few specimens of *C. marthae* from Venezuela have been available for counts and it seems quite likely that anal fin ray counts of Venezuelan specimens will prove to have a greater range than three rays, and that counts overlapping those given for *C. schereri* are to be expected. Since anal fin ray counts appear to be the only difference in these forms and since these counts are the only characters to show the population from Venezuela and from the Upper Amazon to be distinct, I no longer consider the samples at hand to belong to two species. Adequate comparison of samples of populations through the range of *C. marthae* will

possibly show *C. schereri* to be an upper Amazon subspecies.

DISCUSSION

In my earlier paper (Weitzman, 1954, p. 231) I concluded that the Gasteropelecinae probably arose from some generalized characid genus such as *Astyanax, Brycon* or *Bryconamericus*. These genera of the Characidae belong to the morphologically more conservative subfamily Characinae. So far as I have been able to determine, the members of the American and African Characinae have only four branchiostegal rays. Hubbs (1919) has noted that a high number of branchiostegal rays is primitive for teleost fishes and their reduction is a trend in the evolution of teleosts. This is undoubtedly quite true for characids. It has been my opinion (Weitzman, 1954, p. 234) that, in some features, at least, *Thoracocharax* is the least specialized genus of the Gasteropelecinae. Two characters recently found help confirm this opinion. These are, first, the presence of five branchiostegal rays, and second, the presence of an articulation between the frontal and pterotic bones. The frontal bone is in contact with the pterotic in all members of the Characinae that I have examined but they are widely separated from each other in *Gasteropelecus* and *Carnegiella*.

The presence of five branchiostegal rays in *Thoracocharax* poses a problem. As noted above, I have been able to find only four branchiostegal rays in any of the Characinae. This suggests that perhaps the Gasteropelecinae arose from some extinct group of the Characinae that still retained five branchiostegal rays or that it arose at a remote time when most or all members of the Characinae or ancestors of the Characinae and Gasteropelecinae had five branchiostegal rays. However, as Hubbs (1950, pp. 5-7) notes in a discussion of the presence of ctenoid scales in the poeciliid fish *Xenodexia*, it is not unlikely that an element or character once lost can reappear. This is perhaps what has happened in *Thoracocharax* (but not in the other members of the Gasteropelecinae). On the other hand, because of the great specialization in the Gasteropelecinae, one may assume that this subfamily has been evolving for a long time, and that the Gasteropelecinae may well have been derived from some relatively primitive characid with five branchiostegal rays.

Because of the somewhat more primitive morphology of *Thoracocharax* with respect to other members of the Gasteropelecinae, it is placed in a new tribe, the Thoracocharacini. As I noted earlier (Weitzman, 1954, p. 236) *Gasteropelecus* and *Thoracocharax* probably arose from a common ancestor; the one did not arise from the other. *Carnegiella* seems to be a neotenic form (with regard to skeletal and lateral-line features) of *Gasteropelecus* and directly derived from it (Weitzman, 1954, p. 239). Therefore I have placed *Gasteropelecus* and *Carnegiella* in the same tribe, Gasteropelecini.

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THE PHYLOGENETIC RELATIONSHIPS OF TRIPORTHEUS, A GENUS OF SOUTH AMERICAN CHARACID FISHES

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INTRODUCTION

The fresh-water fish genus *Triportheus* is a distinctive group of medium-sized characids (adults are 100 to over 300 mm. in standard length) with elongate and compressed bodies, stiff, long pectoral fins, and an enlarged, keeled thorax due to expanded coracoids (Fig. 1). There are several known species, and members of the genus are recorded from the Magdalena River basin in Colombia east into the Orinoco River system, south into the Amazon and São Francisco River basins, and finally in the La Plata River system. One fossil species, *Triportheus ligniticus* (Woodward), is known from the Tertiary lignites of Tremembé São Paulo, Brazil (see Travassos and da Silva Santos, 1955).

With their keeled thorax and large pectoral fins, members of the genus *Triportheus* look something like Asian clupeid fishes such as *Raconda russelliana* Gray, *Opisthopterus tartoor* Cuvier and Valenciennes, and *Ilisha macrogaster* Bleeker. They also resemble members of the American clupeid genus *Odontognathus*. The Asian cyprinid genus *Chela* has a similar specialization of the pectoral girdle and fin. This type of modification of the pectoral girdle in minnows, clupeids and characids unquestionably arose independently and is an excellent example of convergent evolution. Other genera in the family Characidae with expanded coracoids and a keeled thorax include *Piabucus*, *Pseudocorynopoma*, *Rhaphiodon*, and member genera of the subfamily Gasteropelecinae. As I have previously pointed out (Weitzman, 1954, pp. 230-231), it seems likely that this type of specialization arose several separate times in the Characidae.

The systematics of the members of the genus *Triportheus* is not treated here; however, I agree with Schultz (1944, p. 273) that the most recent revision (Miranda Ribeiro, 1941) is not satisfactory and that the species are in need of more critical treatment. Myers (1940, p. 170) has shown

that the name *Triportheus* must replace *Chalcinus*. Despite the fact that *Chalcinus* was "hopefully retained" by Allen in Eigenmann and Allen (1942, p. 260), *Triportheus* is the correct name.

The classification and presumed relationships of the genus *Triportheus* have been shifted about through the years, but the main controversy seems to be whether their relationships are with the genus *Brycon* or the subfamily Gasteropelecinae. Several ichthyologists have referred members of the genus *Triportheus* either to, or close to, the subfamily Gasteropelecinae (or family Gasteropelecidae). The most recent of these were Travassos and da Silva Santos (1955, p. 309), who placed them in the family Gasteropelecidae. In my paper on gasteropelecin osteology (Weitzman, 1954, pp. 228-230), I included a few notes on the relationships of *Triportheus*, and concluded thst this genus is not closely related to members of the Gasteropelecinae, but that "...if *Triportheus* is at all related to the gasteropelecins the relationship is remote and near the early gasteropelecin ancestors."

THE RELATIONSHIPS OF *TRIPORTHEUS*

Previous to my 1954 work, there have been two papers in which the conclusions on the relationships of *Triportheus* are based on internal as well as external evidence. These are by Regan (1911) and Gregory and Conrad (1938). Interestingly enough, these two papers present opposing views. Concerning these fishes Regan (1911, p. 18) states, "Another genus with the mouth and dentition of *Brycon* is *Chalcinus* [=*Triportheus*], which differs chiefly in the keeled thorax and compressed abdomen; on this account Eigenmann associates it with *Gastropelecus* [sic], but the skeleton is essentially similar to that of *Brycon*." Gregory and Conrad (1938, p. 335) came to the conclusion that the genus *Triportheus* is close to the Gasteropelecinae, for they state, "*Chalcinus* (Text-fig. 2), in its deepened coracoids and large pectoral fins, seems to afford a favorite point of departure for *Gasteropelecus* (Text-fig. 2). Regan (1911, p. 20) rejected this connection and stressed the structural relationships with *Tetragonopterus*. But the latter differs widely from *Chalcinus* (Text-fig. 14B) in the low position of the pectorals, general form of body and mouth, and undoubtedly points rather to *Serrasalmo*. After comparing the skeletons of *Chalcinus* and *Tetragonopterus* with the skeleton of *Gasteropelecus* (Text-fig. 14A), we incline to the opinion that *Chalcinus* is much nearer to the structural ancestor of *Gasteropelecus*."

Gregory and Conrad's contention seems correct when skeletal specimens of *Triportheus*, *Gasteropelecus* and *Brycon* or *Tetragonopterus* are superficially compared. However, a more critical examination of the osteological details of these fishes substantiates Regan's conclusion. In order to present the relationships of *Triportheus*, the genus is diagnosed below, and its characters compared with those of the characid subfamilies Gasteropelecinae and Characinae.

Genus *TRIPORTHEUS* Cope

Chalceus Müller and Troschel (nec Cuvier), 1845, p. 15 (type species: *Chalceus angulatus* Spix, in Spix and Agassiz, 1829, by monotypy).

Chalcinus Cuvier and Valenciennes (nec Rafinesque), 1849, p. 258 (type species: *Chalcinus brachipomus* Cuvier and Valenciennes, 1849, by subsequent designation of Eigenmann, 1910, p. 440).

Triportheus Cope, 1872, p. 263 (type species: *Triportheus flavus* Cope, 1872, by subsequent designation of Eigenmann, 1912, p. 376).
Coscinoxyron Fowler, 1906, p. 450 (type species: *Chalcinus culter* Cope, 1872, by original designation).

DIAGNOSIS.—The genus *Triportheus* differs from other members of the subfamily Characinae in the following combination of characters: Coracoid bones expanded in the sagittal plane, closely applied but not fused to each other; their lamellae flat and smooth. Lower facial bones somewhat elongate so that the joint between the articular and quadrate is at a level anterior to the eye. A second tooth row on each dentary represented by a large tooth placed just lateral to the sagittal plane and inside the main tooth row.

Species of the genus *Triportheus* are like other members of the Characinae and unlike the three genera of the Gasteropelecinae in the following characters: Relatively smooth frontals that are not longitudinally corrugated and are without a strong longitudinal dorsal ridge. The supratemporal (extrascapular or tabular) is a bone loosely applied to the posterior region of the pterotic-parietal joint, and never articulated to the cranium by an immobile syndesmotic joint. The orbitosphenoid is a broad bone in the middle, upper posterior region of the orbit, not a narrow Y- or V-shaped strut. The posttemporal fossae are well developed, being large excavations in the region surrounded by the parietal, pterotic, epiotic and supraoccipital, not restricted to a narrow slit medial to the supratemporal as in the Gasteropelecinae. The posterior vertical semicircular canals extend laterally only about half the distance between the sagittal plane and the lateralmost part of the cranium, not almost to the lateralmost border of the cranium. The posttemporal and supracleithrum are separate, not fused into a single bone. Each pectoral girdle has three postcleithra; there are none in the Gasteropelecinae. The lateral wing of the cleithrum is well developed, not reduced to a low ridge. There are four branchiostegal rays (see below). The pterotics and frontals are in contact by a fairly long joint, reaching to the lateral edge of the dorsolateral surface of the skull, not separated by the sphenotic or in contact only along the lateral border of the parietal bone. Frontal and parietal fontanels are present and well developed even in adults. In all of the above characters members of the genus *Triportheus* differ from the three genera of the Gasteropelecinae, *Thoracocharax*, *Gasteropelecus* and *Carnegiella*, except that *Gasteropelecus* and *Carnegiella* also have four branchiostegal rays. *Thoracocharax*, on the other hand, with five branchiostegal rays, is unlike *Triportheus* in this and all other features mentioned.

DISCUSSION.—From the comparison presented above, it can be seen that *Triportheus* should not be placed in the subfamily Gasteropelecinae (or family Gasteropelecidae). None of the characters used by Weitzman (1960, p. 217) to diagnose the Gasteropelecinae are found in the genus *Triportheus*.

Triportheus belongs to the subfamily Characinae and is like other members of the Characinae in almost all of its osteological characters. The skeleton of members of the genus *Triportheus*, as Regan said, is very much like that of *Brycon*. As I have noted (Weitzman, 1960, p. 233), in my opinion *Brycon* should be placed in the Characinae. Characters of the cranium and dentition are so much like those of *Brycon* that if the pectoral girdle were not modified and the jaws placed rather far anteriorly, members of the genus *Triportheus* would be placed in the genus *Brycon*. Bone by bone comparison of the skull, including the jaws, facial bones and vertebrae of *Brycon* and *Triportheus* shows such a great resemblance between these two genera that I am forced to think that *Triportheus* is only a modified *Brycon* and arose from it. Considering the fact that the osteology of *Triportheus* is essentially like that of *Brycon* and that the members of

Fig. 1. *Triportheus angulatus* (Spix). Standard length 105 mm.

the genus *Triportheus* even have the inner pair of teeth in the lower jaw exactly like those in *Brycon* (a character used by Eigenmann, 1912, p. 254, to distinguish his Bryconinae from his Tetragonopterinae), it seems evident that *Triportheus* represents no more than a comparatively slight specialization of *Brycon*.

In my paper on gasteropelecin osteology (Weitzman, 1954) I concluded, as mentioned above, that *Triportheus* is not closely related to the Gasteropelecinae but that possibly gasteropelecins and *Triportheus* may have arisen from a common stock in the Characinae. This no longer seems tenable. At that time I believed that the scales of *Triportheus* "closely approach the type found in *Thoracocharax*." However, further examination, especially of the scales of *Brycon*, indicates that there is as much resemblance between the scales of *Brycon* and *Triportheus* as between the scales of *Thoracocharax* and *Triportheus*. The scales of *Triportheus* somewhat resemble those of *Thoracocharax* in the development of a central circular groove. However, I have found no scale in *Triportheus* that has a complete circular groove; the groove is interrupted anteriorly. When the circular groove is present in *Thoracocharax* it is always complete. In view of the differences in head osteology between the members of the genus *Triportheus* and members of the subfamily Gasteropelecinae it seems quite possible, and I believe quite probable, that the resemblance between the scales of *Triportheus* and *Thoracocharax* represents a case of convergent evolution.

Also, in my earlier paper, I noted that although the posttemporal and supracleithrum of *Triportheus* are not fused, they superficially resemble the fused posttemporal and supracleithrum in *Thoracocharax*. This true to a certain extent, but it seems reasonable that this resemblance also is due to parallel evolution from a basically similar pectoral girdle in their respective ancestors. The pectoral girdles of *Gasteropelecus* and *Carnegiella* are very much alike and are more specialized than that of *Thoracocharax*.

All the member species of *Brycon* and *Triportheus* (as well as the other members of the Characinae that I have examined) have four branchiostegal rays. *Thoracocharax*, the gasteropelecin genus that in many ways is morphologically the most conservative, has five branchiostegal rays. This would make it seem probable that the ancestors of all living gasteropelecins had five branchiostegal rays. As I have noted previously (Weitzman, 1960, p. 233), this suggests that the Gasteropelecinae probably did not arise from members of the Characinae as they are known today. The great specialization of gasteropelecins suggests that their origin is probably quite remote and that they took a long time to evolve. Since *Triportheus* is not greatly specialized and is much like *Brycon*, it probably evolved relatively recently from *Brycon*. If, as the morphological evidence suggests, this is true, it is highly unlikely that *Triportheus* and the gasteropelecins were derived from an immediate ancestor. Their only relationship is membership in the large and polymorphic family Characidae.

It is my opinion, in view of the morphological facts mentioned above, that *Triportheus* belongs in the subfamily Characinae, and should be referred to the tribe Bryconini, a tribe here considered to include *Brycon* (including *Megalobrycon*), *Triportheus* and *Chalceus*. *Triportheus* and the member genera of the subfamily Gasteropelecinae are not closely related.

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A FORGOTTEN ACCOUNT OF A FRESH-WATER BELONID FISH FROM NORTHERN INDIA

By George S. Myers

Dr. Hugh Falconer (1808-1865) was the founder of vertebrate paleontology in India, the first explorer of the now well-known Tertiary mammalian faunas of the Siwalik Hills, and a botanist of note. So far as known, Falconer was the author of but one published paper on Recent fishes. It is listed in Dean's "Bibliography of Fishes" but has apparently remained unnoticed by ichthyologists working on the Indian fish fauna.

From 1831 to 1842, Falconer was Director of the Botanic Garden at Suharunpore (variously spelt Suharunpoor and Saharanpur) in northern Meerut, just south of the Siwalik Hills and Dehra Dun (see Murchison, 1868, vol. 1, pp. xxv *et seq.*). An almost contemporary account of the district and town (partly derived from Falconer himself) is given by Thornton (1854, vol. 4, pp. 596-603).

Suharunpore is situated between the Ganges and Jumna Rivers, and it was here that Falconer's solitary ichthyological manuscript was written, at some time between 1835 and 1841 (see Murchison, 1868, vol. 1, p. 587, footnote 1; and p. 590, subscript). It formed part II of three zoological notes, the first on a deer and the third on a frog, and concerned a supposed new needlefish from local streams. Falconer himself never published it. However, the manuscript was found among Falconer's papers after his death and was included in the republication of Falconer's paleontological works by Murchison (1868, vol. 1, pp. 589-590). The entire paper is herewith reproduced:

II.-Note on an Indian Species of Esox
Esox (Belone) Hindostanicus (Falc.).

Malacopterygiens abdominaux, Cuv.; Gen. *Esox*.—Muzzle long and attenuated, with a large gape; upper jaw with its sides composed of the intermaxillaries, which have a posterior pedicle, the maxillaries being concealed under the tips and not entering into the composition of the jaw; teeth in both jaws, some of them long, pointed, and distant, the intervals occupied by a row of smaller teeth; no teeth in the palate. Lower jaw projecting beyond the upper; no adipose fin or barbillae; opercula and branchial openings large; body and tail elongated, the latter compressed at the sides; scales cycloidal, small, hard; dorsal and anal fins short; one dorsal fin placed right above the anal.

Subgen. Belone, Cuv.—Dorsal fin with 16 rays, anal fin 18 rayed; branchial membrane 14 rayed; caudal fin, with a nearly rectilineal termination (no échancrure), 19 rayed; head rather small; lower jaw extending beyond the upper, both being straight, and twice as long as the head proper; body and tail cylindrical and serpentiform; two longitudinal ridges, with an intermediate ridge, and bounding furrows along the back; a mesial lateral line from the tail to the opercula, and a longitudinal coronated line of scales on either side towards the belly. Pectoral fins 9 rayed. Ventral fins 6 rayed.

The muzzle long and needle-shaped; total length of body and muzzle about 8½ inches; diameter of the body half an inch; the teeth are of two sorts—one very long and needle-shaped, rather distant, the other shorter and occupying the intervals; eyes very large; head flattened above, with a deepish and broad longitudinal furrow; a membranous pouch under the fork of the

inferior maxillaries; body green above, white underneath; intestine short, straight, and thick; no coecum.

Called by the natives of Hindostan 'the Cowah Muchee,' or Crow-billed fish. Sometimes attains 18 inches.

Forms a distinct species, nearly allied to the marine *Esox Belone* of Cuvier, but differing in number of rays to the fins, and in having a straight ended, not forked, tail.

Inhabits nullahs and stagnant waters at Suharunpore; common.

Swims horizontally, with a zig-zag motion, like an eel. It is eaten by the natives.

Although no one of the more important works on Indian or Asiatic fishes mentions Falconer's description, there seems to be no question that *Esox (Belone) hindostanicus* Falconer is a synonym of *Xenentodon cancila* (Hamilton) 1822, as the latter is currently recognized. However, if geographical subspecies of *X. cancila* are ever recognized, Falconer's name *hindostanicus* must be considered.

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THE NAMES OF THE SOUTH AMERICAN CATFISH GENERA CONORHYNCHOS AND DIPLOMYSTES

By George S. Myers

The tendency of French zoologists to avoid Latin and Latin names for animals runs back at least to Buffon, and has caused a great deal of trouble to non-French systematists who are ignorant of this idiosyncracy. French scientists of the Eighteenth Century were the first to cast aside the only international language that was ever of general currency in favor of their own vernacular, and most of the French zoologists were slow even to adopt Linnaean binomial nomenclature. Buffon's great and profoundly influential work on natural history was begun before Linnaeus began the uniform use of binomial names, and Buffon himself never adopted the Linnaean practice. Cuvier followed and solidified the French tradition. He failed to supply Latinized Linnaean names for many of his new genera, and almost uniformly refused to use anything more than French vernacular

names for groupings higher than the genus.[1] Even at the present day, the majority of French zoologists entirely avoid using the accepted, Latinized terms for families and orders, and instead employ vernacularized derivatives of them, even in formal publications (e.g., Cyprinidés for Cyprinidae). In some instances, it should be noted, the French vernacular name for a genus is spelt like the Latinized version, in others not.

The failure to understand or consider this matter has led to the occasional acceptance, by unwary zoologists, of a French vernacular name in the mistaken belief that it was a validly proposed Latinized name. This has occurred in connection with at least two important catfish genera.

Fowler (1951, p. 522) has accepted, as the valid name for the pimelodid genus usually called *Conorhynchos* Bleeker, the French vernacular term "Conostome" used by A. Duméril in 1856 (p. 484). This is inadmissable. Duméril used French vernacular names for genera throughout his work. Occasionally these happen to agree in spelling with the Latinized versions of other authors. Usually they do not. Fowler (loc. cit.) is in error in saying that Duméril also used the Latinized form of the name, *Conostoma*, in the same publication. In any event, *Conostoma* was preoccupied and cannot be used.

Bleeker (1858, pp. viii, 191, 205, 209) proposed the name *Conorhynchos* for the same genus, pointing out in several places that it equals "*Conostomus*" of Duméril. Fowler (loc. cit.) quotes this error of Bleeker's as the proposal by Bleeker of a new name, *Conostomus*, for the same genus. Bleeker merely misquoted Duméril's vernacular French name "*Conostome*".

In 1860, the name *Conorhynchus* was apparently proposed by Motschulsky in Coleoptera (reference not checked). In 1861, Gill used *Conorhynchus* for for *Albula*, but neither of these uses preoccupy Bleeker's name of 1858. Regan (1908, p. 192), believing Bleeker's name to date from 1863, proposed the substitute name *Conorhynchichthys* for *Conorhynchos* (or *Conorhynchus*) of Bleeker. The substitute name is unnecessary.

It follows that the valid names of the South American pimelodid catfishes concerned are still *Conorhynchus conirostris* (Cuvier and Valenciennes) and *Conorhynchus glaber* Steindachner. The Mexican ariid catfish erroneously referred to this pimelodid genus by Evermann and Goldsborough (1902, p. 140) as *Conorhynchus nelsoni* still awaits the new generic name that Prof. Hubbs has planned for over 25 years to bestow upon it.

Much the same thing has happened in regard to the generic name of the most generalized of living catfishes, commonly called *Diplomystes* (see Gosline, 1945, p. 6). Again Duméril (1856, p. 487) gave the genus a vernacular French name, "Diplomyste", with no mention of a Latinized version anywhere in his book. The name was Latinized, as *Diplomystes*, by Bleeker (1858, pp. 56 and 63) with *Arius papillosus* Cuvier and Valenciennes (equals *Silurus chilensis* Molina) as monotype. Günther (1864, p. 180) later emended the name to what he considered to be a better form, *Diplomystax*. The two presently recognized species are *Diplomystes chilensis* (Molina) of Chile and *D. viedmensis* MacDonagh of Patagonia. Whether *Diplomystes* or *Diplomystax* preoccupy the later name *Diplomystus* Cope, for a genus of doubly-armed Eocene Clupeidae, is a subject I do not wish to take up at this place.

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[1]One perfectly logical Cuverian practice is still misunderstood by most modern taxonomists who encounter it for the first time. When a new monotypic genus was discovered and named, no species name was considered necessary and often none was bestowed. The logic is, of course, that the generic name (a substantive or noun) *is the name* of the animal (or plant). The so-called species name or trivial name is usually not a name (substantive) but a mere modifier of the generic name. When only one species of a genus is known, no modifying adjective is needed. All modern taxonomists, in conversation, and often in writing, unconsciously hold to this rule.

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